WHAT I KNOW ABOUT FARMING

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Yours very truly,

ELLIS J. GRINNELL

What I Know About Farming

A Record of Thirty-five Years of Practical Experience in Agriculture and Horticulture

By

ELLIS J. GRINNELL

"To conduct a farm in a proper manner requires a knowledge of more facts and principles than to conduct a bank successfully."

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This book is dedicated to those women of America who, through their intelligent and indispensable co-operation in the work on the farm, are so important a factor in the development of this ennobling industry.

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Preface

This book is the outgrowth, as the title declares, of forty years of a mature experience of the life of the all-around farmer. I was born on a Central New York farm, grew to manhood on the same farm, and managed it for twenty-five years thereafter. Then circumstances sent me to other parts of the United States to continue along the same lines of agricultural and horticultural work. In those forty years, however, the outlook of farming in this country has greatly changed. Realizing this fully, from my wide acquaintance with the various farming sections of the nation, I have written these pages, in the hope that I may aid the young farmers of the day by presenting methods of work which are the results of a practical adjustment to each other of the old and new ways of farming. Very little is set down in the work which has not had the test of my own labors in one field or another. For such few pages as are gleaned from the practice of other farmers I have aimed to give credit where due. Acknowledgements are also made to the valuable agricultural papers of the country for suggestions in their columns which corroborated my own field work. Especially is credit given to Farm, Stock and Home, the Northwestern Agriculturist, The Farmer and the Canadian Thresherman.

During the past few years there has been a loud call of "back to the land." Today the business of farming and horticulture is made to appear more attractive than ever before by the alluring advertising literature which is issued in such profusion by the numerous land companies and colonizing agencies in all sections of the country. To the uninitiated and to those who have had limited experience in agricultural pursuits I wish to sound a note of warning: Farming is a serious business. It requires just as much brains to be a successful farmer as it does to be a successful merchant or manufacturer, for it is really a combination of both of these. It requires a certain amount of capital to start even a small farm, and in this respect too, it is not so very different from other legitimate lines of business. I trust that before embarking in the business of farming my readers will first count the cost. Farming is a good business. It is a useful, a necessary and a dignified occupation, upon which practically all other lines of industry depend. In one way or another, the prosperity of the whole country is regulated by the activities of the farmer.

It is hardly possible to learn all about a subject from books, no matter how well they may be written. Practical experience is necessary to round out one's education, and my advice to the beginner in any of the various departments touched upon in this book, is to begin slowly. If you are destined to become a farmer, study the business from every possible angle. Keep posted by reading agricultural reports; get acquainted with your prosperous neighbors, and study their ways of doing things. Don't lose an opportunity to attend county and state fairs. Co-operate with those who are in the same line of business as yourself; attend local grange meetings, and in every possible way help with your voice and best efforts to dignify and benefit your chosen calling, for in this, as in other lines of occupation, what is for the best interests of your neighbors is also best for you.

CHAPTER I

Soil and Perseverance

A MAN who had been a practical farmer for over fifty years in the west, was asked one day what his methods of farming had been that he had been so successful. Being a man of few words, he replied, "My methods? I didn't have any to begin with. I just found 160 acres of good rich soil that Uncle Sam gave me—and then—well, the rest was mostly what grit I put into it."

My farmer friend was not so far out of the way. In fact, if he had put "grit" the first of his two requisites, and the soil second, he would not have made any mistake. No man is fit for a successful farmer unless he has enough sand in his make-up to outweigh what he may find on his land. Yet, while the man behind the plow is the first factor in good farming, the character of the soil decides the market value of the farm. It is possible to buy poor virgin soil, and, by a continual outlay of time and money, make it over into good farming land. The time is coming when this kind of transformation will be a necessity to the world. But it is not yet so near that this book is written especially for the needs of such restorative agriculture.

It is assumed that the farmer who reads these chapters has already some reasonably good acreage, or that he plans to possess such acreage soon. Granted that, how can he make the most out of his farm, large or small? How can be get big crops with the least cost to himself—and to the land? In other words, how can he keep his land fertile?

These, and kindred questions, must be answered by the practical farmers of today in order to make farming pay dividends. The big farms and tracts of land are fast being cut up into smaller ones to meet the demands of a rapidly growing population. This means that every square foot of the smaller farm must be brought up to a profitable fertility, as is now the case in the old country, and this involves a systematic, if not a thoroughly scientific, rotation of crops, which will insure large yield, while conserving, if not increasing, the fertility of the soil.

Every farmer of today must realize the enormous waste that goes on where only one crop is raised year after year, and he appreciates the fact that diversified farming is the logical solution of the farm conservation problem. Here every part of the operation and growth is dependent upon every other part. Fertilizers from the barns, stables and stockyards go to the fields and pastures, and the crops, in the shape of feed, go back again to the barns, stables, stockyards like an endless chain. Where before there were only one or one and half tons of hay to the acre, under these conditions three tons can

be produced; where before 35 or 40 bushels of corn were raised, now 90 to 100 bushels can be grown; and so it is with wheat, formerly 12 or 15 bushels, now on well conducted farms 30 bushels can be raised. The farmer's soil, not unlike his animals, must be cared for and fed to produce the best and most lasting results. No one would expect to get a good rich milk from a starved cow. Why then should he attempt to farm on starved land?

Discouragements will come and harvests will be bad. The best soil "goes back" on a man in some years. But through ups and downs, the farmer, whether born a farmer or made a farmer by force of circumstances, will learn that fertility depends upon certain materials in his soil, and that thorough, increasing cultivation is just as much needed that good soil may remain fertile, as to give fertility to barren lands.

What Is Soil?

The soil contains, in varying quantities, those materials which are necessary for plant growth. By careful handling we may change the relative proportion of those materials. By keeping the soil in such a state, through proper and timely cultivation, that heat, frost, air and water can have the best chance to work upon it, to disintegrate the particles and make the important ingredients available, and to keep it sanitary so that the roots of the growing plant lying in this mass of well kept matter called soil, may have the best possible environment, the best soil will remain best and the poor soil will gradually grow better.

This brings us to the question of the formation, properties and constituents of soils. Briefly, soil is that part of the earth's crust in which plants are able to grow. It was originally formed from the rocks, by disintegration and erosion. To these particles have been added from time to time, more or less animal and vegetable matter, called humus. These various deposits when carried to new localities by water, change their character. Examples of this are the valley of the Nile River in Egypt, and our own Mississippi valley. These valleys have benefited by the large amount of humus which they received at the expense of the other and higher regions.

Soils possess both physical and chemical properties. Among the most important physical properties of the soil are: The size and form of the soil particles; their relation to heat, cold, air and water; their weight and their color, order, etc.

These properties have considerable bearing in determining what use to make of a certain soil. The size of the particles determines the class of soil; thus clay is composed of the finest particles, and derives the quality of slow percolation of water from this condition. Silt ranks next in fineness and then comes sand. Each of the above named soils is particularly adapted to some class of crops and poor results are usually obtained by attempting to grow other groups of crops on them. The best potato soil, for instance, contains a very large proportion of sand, corn soil possesses about an equal proportion of sand, silt and clay, while the best grass and grain soil has a

preponderance of silt. A wheat soil, however, should be finer than for other small grains, so a soil containing a larger proportion of clay can be used.

The Essential Elements.

Water in its relation to the soil is far and away the most important of the elements. Of course the alternate action of heat and cold upon the earth's crust in disintegrating it cannot be underrated, neither can the action of frost or air be left out. But without water there would be little need of any of the others so far as vegetation goes. Water may be found in the soil as bottom water—the distance of this from the surface may be told generally by the depths of wells of the community—and as capillary water, or that water held by capillary attraction between the particles of the soil. This is an important source of water supply to plants and may be conserved during dry weather by intelligent cultivation and mulching.

On the other hand water may be lost to the soil, (1) by percolation—the downward tendency of water mostly in sandy soils. This is bad because the plant food is carried too far down to do the plants any good. In loose soils this may be remedied by the addition of humus. (2) By evaporation, or the loss of water by the action of the air. This can be prevented largely by mulching and cultivating. (3) By transpiration, or loss of water by evaporation through the leaves of the plants. This loss cannot be prevented and the hot dry winds often cause the plants to wilt because transpiration takes place so rapidly.

Micro-organisms have been an important factor in the production of soils. Their action upon the soil is both physical and chemical. While there are between 65 and 70 elements in the soil, only about 12 are known to be essential to plant and animal life, three particularly necessary. These are nitrogen, phosphoric acid and potash.

Nitrogen is a constituent of chlorophyll, the green coloring matter of plants, and when there is a dearth of it only a limited amount of chlorophyll can be produced. If nitrogen is absent from the soil, plants do not make any appreciable growth; the leaves do not develop, and, as the leaves are the stomachs of a plant, the whole organism suffers. Nitrogen is particularly necessary during the early part of the plant's growth; for example, wheat uses about 85% of its nitrogen before the plant heads out at all.

Those plants with rich green, well developed leaves, are not in need of nitrogen. Too much available nitrogen causes the plant to direct its energy to wood-making and not to the production of fruit and seeds. Plants are also able to take nitrogen from the air. The most common example of this is the clover family, which extracts nitrogen from the air and deposits it in nodules at the roots of the plants. Raising clover is one of the best ways of adding nitrogen to a soil.

Phosphoric acid is also very essential during the early part of the plant's growth. In the case of the wheat plant, it has been

shown that 80% of all phosphorous used is taken up during the first half of its growth. Light-weight grain results from an imperfect phosphorous supply.

Like the other two essential elements, potassium or potash is needed in the early stages of plant growth. It goes into the building of fibers, woods, etc. In a grain crop it is present in leaves and straw. Wood ashes are rich in potash.

Another element which is very important and by some considered as essential as the first three is lime. A soil lacking in this element grows plants lacking in hardiness. Grain crops do not remove very much lime while clovers take a great deal. Lime not only acts upon the soil chemically and combines with other elements to make them available as plant food, but improves the soil physically, if, of course, it is not present in too large quantities.

A rocky or an arid soil with clay subsoil often has available large quantities of these elements and only needs irrigation and cultivation.

All California needs to make it the garden of the United States is water. The same might be said of many other localities now awaiting national irrigation projects. On the other hand, a soil with an abundance of moisture may become so water-tight that the action of the atmosphere is hindered and thus the greatest factor in the health of the soil becomes an evil. Neither from stones nor muck-holes can a farmer make a living. Yet what shall he do with the rock or the swamp-land if he happens to possess them?

Swamp-Land and Jack-Pine Lands.

The rocky land at once suggests its own cure. The few farmers of New York now living who can remember how they built the stone walls that fenced off their acres two generations ago could tell us something on this point. But the value of the swamp-land is not yet so well understood as it will be when state drainage has reclaimed the thousands of acres still left for the coming settlers to beautify and make productive by intelligent agriculture. It is especially rich in humus, as a rule, having received for ages the washings of the surrounding lands. And where the proper scientific use has been made of the little swampy corner of the farm home, it has been able to return the interest on the money invested in its drainage sometimes many fold. The same may be said of the jack-pine lands and of some ordinary pine lands. Instead of leaving the lands behind him to move on further west, the young man of small means would do better to try his skill at continuous yields of clover upon the better class of jack-pine lands. The department of agriculture has a bulletin based on the investigations of one of the department's workers in the jack-pine lands of Michigan. There clover has been grown for seed with yields of from 2 to 6 bushels an acre, at the same time greatly benefiting the soil. But the intending farmer is cautioned not to expect his farm to reach a high state of cultivation for at least three or five years. After that he can carry on such diversified farming as the locality permits.

The requisites to success on these lands are:

First.—Summer fallowing or plowing all vegetation under during the summer. The first plowing should not be deeper than about 4 inches. The next plowing not more than 6 inches.

Second.—Leave a natural windbreak of trees and shrubs along the north and west borders of each field.

Third.—Make fields narrow north and south, long east and west.

Fourth.—After seeding roll thoroughly to bring up the soil water.

Fifth.—Harrow with a spike-tooth harrow to give a loose top soil. This prevents surface evaporation. A rough surface has also been proven to reduce the force of the wind next to the soil to at least half the velocity it has when blowing over a smooth surface. This method is simply mentioned here to show what may be done with land generally supposed to be worthless for agricultural uses; and is a method recommended by one of the leading professors of an agricultural college in a state where jack-pine lands are found in sufficient quantity to check ordinary farming methods and scientific farming is needed to get results. Purchasers of jack-pine lands, however, should be sure that the sandy surface does not also mean a sandy sub-soil, which will not retain fertility. If there are any settlers near where you are planning to buy, look at their clearing to see what crops can be grown. Never buy jack-pine or swamp land without seeing the land first. Then make sure that you will get the land you are bargaining for. Gravelly land has often excellent soil, and if the price is low enough, will pay for the time spent in removing stones. Do not buy swamp lands so deep under water and muck that they will need thousands of dollars of drainage work before their real soil value can be developed. Lands like all of these are found in the northern portions of Wisconsin, Michigan and Minnesota, sometimes in almost the same locality as land with cheap yet profitable possibilities in it. Look before you leap.

Natural Forestry An Indicator of Soil.

In selecting locations for farming one can usually tell the value of the soil by noting the kind and condition of the timber that grows thereon. Of course this method of judging lands can not be used on prairies where no trees are found.

If the trees in a certain locality are short in trunk or body, small in diameter and have a thick head with small limbs the subsoil is generally porous or leechy, having a mixture of sand and gravel. The natural surface soil will contain only a small percent of foods for agricultural uses, if cleared. These will soon be exhausted if cropped. However, many soils of this kind have been bought up to a paying basis by applying large quantities of barnyard manure and seeding to clover or alfalfa. Fodder corn is grown and fed to the cattle so that it all goes back to the land.

On the other hand if the trees are tall and large in diameter without the scrawny appearance that characterizes light soil vegetation the soil is without doubt rich in food stuffs and the subsoil is deep.

The subsoil is the essential thing to look for because it is really the reservoir for retaining the water that leeches from the surface soils. If the subsoil has plenty of moisture in it the vegetation will thrive even in a severe drouth, but if the water content is exhausted during dry weather there is little chance that vegetation will survive.

An example of this was the spring of 1911—The season before had been very dry so that little if any moisture was left in the soil over winter. I had some nursery stock to set out in the spring and I found that the subsoil contained no moisture. After putting in the stuff I hauled water and filled up the subsoil to overflowing. I had no trouble with these trees.

A heavy clay subsoil is the only subsoil that will retain a large deposit of moisture for a long drouth.

Poor Soil Made Good Soil.

Yet, as to poor soil, roughly speaking, there is comparatively so little poor soil in this country that I believe we can yet rival Japan in intensive farming; and there it is stated that the population averages 5,000 to the acre. It is poor farming that is the matter with us. We leave the plant food all sealed away in the soil's depths, and scratch over the surface to get results in the easiest way. Cultivate, cultivate, cultivate, and then some more! Work the earth about your crops, where you think your poorest soil is, persistently and faithfully twice a week during the season of growth, and you will find your crop will mature early enough to enable you to grow other crops. Even where you think there are no possibilities, and so pass on to some other locality, another and more courageous man—perhaps the Swiss farmer from the mountain slopes of Europe—will come along, take the land you rejected, and by using his brains, his courage and his capacity for hard work, develop commercial returns and a good living in a few years.

A good farmer must know what the soil of his farm possesses of plant value and what it lacks. He must be able to tell when it needs to be helped along, and what is most likely to help it. He ought also to know what cereals and vegetables he can grow in his own latitude, and what ones it would be useless to plant. He must know how to feed and care for his different stock when well, and how to avoid animal diseases or to fight them when they come. He must know equally as much about plant diseases and insect pests. And he must never think he knows it all, for there is nothing that gives more surprises than farming does. Nature has a way of upsetting all our calculations every now and then. The only thing to do is to keep on working to get the biggest results with the smallest possible loss of time, labor and money, and then not be discouraged if, occasionally, we should only clear expenses and make a year's living for the family. Scientific farming pays in the long run, and in the

meantime, the farmer is independent of most of the worries that dog the life of the business man of the city.

Therefore, don't think if you expect to make the most out of your soil today, that book-farming has no value. It stands to reason that the man who gives his time to the study of soils—as do the men of our agricultural colleges—must know more about the kind of soil needed for growth in any locality than does the young fellow who has only depended on the seasons and the weather. The practical farmer and the scientific farmer both need each other, and whether a man occupies his own or another's farm to begin with, his success depends upon his not making too many mistakes at first. Take a good farm paper, get an analysis of your own farm soil, find out what it lacks of fertility's elements, and then put the lack in by your own grit and intelligence.

CHAPTER II

Soil Fertility

HOW to increase fertility is becoming more and more the problem of farming. The rapid increase of population in the past half century of this country has not only sent more settlers to the virgin and rich soils of the middle west and far west, but it has packed cities full of the laboring and business workers. The demand for farm products now begins to exceed the supply just at the critical point when an overworked soil appears to refuse to yield the big crops of the past

There is no cause for worry about this. The land is still with us, with the same possibilities that it has always had. We must treat it better, give it our best intelligence in the way of farming, and then recognize that intelligence by fostering the business of the farmer. Just as we encourage manufacturers to come to our cities, so must our states offer help to the incoming settlers by liberal land laws, protection from land sharks and boomers of the wrong stripe and, above all, a persistent and economical teaching of the best agricultural methods adapted to the different sections of each state. The easiest way of farming has been exploited to a dangerous success, which is now leaving us with abandoned farms in the east, and tired-out bonanza farms in the west. But let us accept the alternative of the necessary rebuilding and retrieving of land that this puts upon the future of farming. With firm faith in the American spirit of energy and resources, let us get to work at farming in the right way. For the American farmer will come to his own in this century as he never has done before. Farming, for nearly a hundred years, has been carried on by dumping manure into ravines or rivers, or leaving it in heaps until its value is gone and the substance is ruined by fire-fang; in burning the straw; in burning over pasture, and in selling all the grain raised and putting nothing into live stock.

The whole subject of soil exhaustion, therefore, from this and other causes, becomes one of vital importance to the farmer everywhere. The fertility, and therefore the market value of land, depends upon its available supply of plant food. Nature has put into the soil of the great Northwest large stores of plant food. This food had been accumulating for thousands of years before the pioneer came, until the prairie sod had become very rich and overflowing with plant food. Yet the Minnesota farmer will tell you today that it would take at least three crops of wheat, as now raised, to make, or equal, one raised when the prairie sod was first plowed. This state has come about by what may justly be called wholesale soil robbery.

The great problem now with many of our farmers seems to be how to manage their farms so as to make the soil, or plant food re-

maining therein, sufficiently available to produce a large crop yield. Whatever kind of a fertilizer the soil may need, the crop by its quality is the only sure indicator of that need.

Soil Robbery.

Prof. J. J. Jefferson, of Michigan, says that to produce 40 bushels of wheat to the acre, with the straw removed from the field, takes food stuff from the land as follows: 35 pounds of potash, 28 pounds of phosphorous acid, and 68 pounds of nitrogen. To produce 40 bushels of oats per acre, with the straw removed, requires 40 pounds of potash, 15 pounds of phosphorous acid, and 37 pounds of nitrogen. To produce 60 bushels of corn, 70 pounds to the bushel of ears, with the stalks removed, it requires 48 pounds of potash, 42 pounds of phosphorous acid and 72 pounds of nitrogen. This being true, it is easy to determine the cause of the shrinkage of our crops from 40 bushels of wheat per acre to 12 bushels per acre, and a very poor grade of wheat at that.

This kind of soil robbery has been going on for 40 or 50 years, while the farmer has burned, and in many cases still continues to burn the straw stacks which contain phosphorous, potash and nitrogen and much other plant food; raising very little clover—the great soil repairer. To restore this immense loss of plant food again to the land is the great problem for the farmer to solve. This can be done in part, or in whole, by careful conservation of all the resources from the land, by rotation of crops, and by choice of crops.

Burn no more straw stacks, keep more stock, keep them well bedded with straw and spread the manure over the land as much per acre as you can well plow under. The first year after this is done, the best crop for the land is corn, potatoes, or some root crop that requires cultivation. The next crop may be of some kind of grain seeded down for grass. Let the above land now remain one year in clover. Now for hay, or pasture it. The next spring spread 20 or 25 loads of coarse stable manure per acre over it. Plow this under and plant it again, as before, to some root plant that requires cultivation. Be sure to keep all weeds down.

Crop Rotation.

If you will continue this rotation of crops for a few years you will find that your land has been replenished with phosphorous, potash, nitrogen and all other plant foods, and it will not be necessary for the farmer to sow salt as a fertilizer, as is done in many of the eastern states

The importance of changing seed grain from one kind of soil to another kind of soil cannot be emphasized too strongly. For very often grain that has grown on new land, will make the very best grain to sow on old and poorer soil, as the plump and heavier grain makes a better growth than seed that has been grown on old and lighter soil. It is always the good, clean, plump seed that secures the best crop.

When sowing clover to be plowed under, use 8 to 10 quarts of

the Mammoth or Pea Vine clover, and plow under when it begins to bloom. Never, or very seldom, sow the same kind of grain on the same field year after year.

Summer tillage should be observed only in connection with a rotation of crops that will restore the plant-food and conserve the moisture of the soil. One rotation that can be recommended for fairly good soils is: "Summer till and sow winter wheat; disk and fall plow the wheat stubble for corn the next year; disk the corn stubble for a spring grain—oats, wheat or barley; apply manure during the winter; disk in spring and plow for (sorghum) cane, which crop completes the rotation." Another means of restoring the humus content of the soil is by turning under green crops of rye and cow peas or other green-manuring crops. This method has given almost the same advantages as summer tillage, at the same time enriching the soil by the addition of humus, but in very dry years trouble may be encountered through lack of sufficient water to rot the large amount of vegetable matter turned under.

In average seasons, fall plowing is always best done in time to get on a cover crop. Unless the soil is very heavy and tough it should not be exposed to the winter frosts without plowing first, after manuring heavily. Then follow with the fall and winter grains, or with some root crop like turnips. If sod land is to be planted in the spring, plow it as early in the fall as possible, so that the decay of grass and roots will begin before hard frosts. Leave the land in ridges for this purpose by setting the furrow slices up on end. But if sod land is to be fall planted, plow as soon as the grass is cut, fertilize and work over with harrows often until about ten days before fall planting; then cross-plow and seed.

Poisoned Soils.

The Bureau of Soils of the United States Department of Agriculture says that rotation of crops is demanded on the farms of today because their soils are poisoned, not exhausted. The Bureau declares that every kind of plant excretes a substance that is poisonous to itself, but this substance may not be detrimental to other crops, and may even be beneficial. By growing the same crop, say wheat, upon the same land year after year, the toxic or poisonous substance given off by the roots of the wheat plants accumulates to such an extent that the soil actually becomes poisonous to wheat plants and they refuse to grow there. If no other crops be grown on that land, or it be fallowed, these toxic substances disappear and wheat can again be grown there. Thus we have the benefits of rotation.

If manures or fertilizers be added to this soil, they have the power of neutralizing the poisonous substances so that wheat can again be grown there. The manures or fertilizers also add new plant food to the soil, but this is a secondary consideration, as the principal reason for adding it is to neutralize the toxic substances excreted by the roots of the previous crop.

Perhaps this theory may explain why grasses are injurious to young trees. The experiments that have recently been carried on at

some experiment stations show that grass growth does have an actively poisonous effect on tree roots.

Seed Sowing.

Do not forget that the character of the soil has a good deal to do with the method of rotation and of seed sowing, whether for virgin or worn-out land. On soft, spongy lands that lose surface moisture quickly, the seed should be buried deeply. The dry Northwest areas usually need much deeper planting than further to the east. If the soil is a heavy clay, a light covering can be given to the seed. It is usually best not to plant grass seed as deep as grain, but I have known of instances when the soil was of that sort that sinks easily under tread, where grass seed and grain seed have been mixed together and sown alike as to depth and the results have been successful.

As to the comparative merits of Medium Red and Mammoth clover, a very good rule to follow is to use the Mammoth variety where it is apt to be dry, oftentimes for a long period, or where the soil is sandy on the surface but with deep clay subsoil. In general the Mammoth will endure dry weather and cold winters better than the Medium Red, though it is not so free a late fall grower as the latter. As a seed producer, however, it is more valuable than the other variety. Wisconsin and Northeastern Minnesota are specially adapted to the growth of Mammoth clover, and there large crops of seed can be raised in good seasons.

Commercial Fertilizers.

As I have said before, all soils are made up of small particles of disintegrated rock, with more or less of humus in the substance. If a soil is made up of small particles of rock it will be better able to gain and retain air and water than if it is of larger particles. It needs a loose, warm soil for corn, and deep cultivation to set surplus water at liberty, so that the ground will be moist yet warm. This is why constant cultivation is the farmer's duty in the corn field. In a fine soil bed, the empty spaces between the particles of rock, which represent from one-third to one-half its volume, should be filled with air and water in about equal parts. If there is nothing in these empty spaces but air, the soil is too dry, and needs deeper hoeing or plowing to bring up the moisture below. In prolonged drouth, constant cultivation with fertilizing gives the result of a soil mulch to retain whatever moisture may be below the surface soil. But the fertilizing, with stable manures, is a prime principle for conservation of all soil values, and also for the best development of the three chief elements of plant food in the soil, nitrogen, phosphoric acid and potash. Almost all the commercial fertilizers now sold are what are called complete fertilizers—that is, they have all these three plant foods mixed in different percentages. Unless the farmer is sure that his land needs exactly that balanced ration of nitrogen, phosphoric acid and potash, he may be doing his lands more harm than good by doping them with any one of these graded fer-

tilizers. Much better for him to find out what his soil needs of either of these, or all, then buy his own plant foods, and mix them himself at home.

The Pennsylvania Agricultural department says that, "the best index as to the needs of any particular soil is the character of the field crops grown before planting vegetables. A vigorous growth of stalk and leaf, the leaves showing a rich, dark green color, are positive indications that the soil contains a liberal supply of nitrogen, but even such soils generally need more nitrogen for the most profitable gardening operations than is necessary for general farm crops. Sandy and gravelly soils are nearly always deficient in potash, and when this element is wanting there is lack of vigor shown in the wood of the tree fruits, the fruits are not of high quality, and the grasses do not make a thrifty growth. Clay soils usually contain an abundance of potash, but not so much phosphoric acid, so that phosphates are generally needed in such soils; in fact, they are needed in nearly all classes of soils."

The farmers in a Maine agricultural district not long ago joined in a co-operative club for the home mixing of fertilizers. They clubbed together and purchased bone tankage, cotton seed meal, nitrate of soda, acid phosphate, and sulphate of potash. These were screened on a barn floor and mixed by shoveling together four times. The mixture was applied to potato fields and the yields were as large as where the standard commercial fertilizers were used. The mixture used per acre was, tankage, 500 pounds; cotton seed meal, 200 pounds; nitrate of soda, 100 pounds; acid phosphate, 400 pounds; sulphate of potash, 200 pounds; total, 1,400 pounds. This is of course a heavy fertilization but a heavy yield of from 300 to 350 bushels per acre resulted.

A suggested mixture for potatoes to be used on sod land, where a good stubble and aftermath has been plowed under, or in connection with manure, is as follows:

Nitrate of soda	100 pounds
Screened tankage	200 pounds
Acid phosphate	300 pounds
Sulphate of potash	200 pounds
Total	800 pounds

The above mixtures are intended to supply sufficient fertilizing material for a crop of 300 bushels per acre. Attention is called to the fact, however, that in using these fertilizers they are only suggestive and that different conditions of soil make different treatment necessary. In no case is it to be expected that fertilizers will take the place of good frequent tillage and care of crops.

If intending to make these home mixtures, buy the materials for them only upon a guarantee from a reliable dealer, and get a high grade quality of the materials.

From 20 to 40 bushels of slaked lime per acre is a good proportion of this fertilizer. Use only a little at first, where soils are

heavy or sour, and see what the effect is upon the land. Occasionally lime applied only in the fall is a good method for results, but, as a rule, for the best returns the use of lime both spring and fall is advised. Lime is an indirect fertilizer, being a specific in its tonic influence upon too hard and compact soils. It breaks up the soil and sets free the three elements of phosphoric acid, nitrogen and potash, so they can more readily contribute their plant food to the growing plant roots. If a plot of the farm has been badly cultivated put on at least a ton of caustic lime to the acre in the fall, and at least a half-ton more of slaked lime in the spring when freezing and thawing are still going on. If the soil is of clay mixture two tons in the fall and one in the spring are advised. Use the manure spreader but never put on caustic lime unless the field is not to be planted or sown for several months.

Testing Soils.

As to judging your own soil, it often needs a man with a practical experience of years to form a correct value of any soil. For grain raising especially, both surface soil and sub-soil should be studied. The treatment which a gravelly loam and a fine sandy loam should receive, or the crops which can be best raised on these two types, is a matter for scientific understanding of the nutrition in each soil, and what each needs of help. The same is true of the clay loam, black loam or heavy clay soil, and of the limestone soil. Each one answers in a different way to the demand for the earth's products of food or flowers, though fertilizing thoroughly and cultivating thoroughly will work wonders with the poorest soil.

Soil in the same state is apt to be very different in different parts. This is another reason why it is desirable wherever possible to get an analysis of the soil of the farm. In most states, however, this is an expensive process, and many farmers cannot afford it. The state should do this work without charge to the farmer, although he should direct the work on his own land if he feels that he is unable to gauge correctly the character of that land by the crops he can grow. In any event, a definite and scientific knowledge of the merits and demerits of the profitable and unprofitable fields on every farm, and the causes of these, would keep a good many dollars wasted in saving at the spigot to spend at the bunghole. It costs just about as much in cash to raise a poor crop as a good one, while the wear and tear upon a man's energies and enthusiasm for farming is the most uneconomic use of time and labor. But you can easily find out where "humus" will return you gain or where it will not.

The Value of Manures.

The United States Year Book of Agriculture not long ago gave the following summary of the relation of humus to soil fertility:

"1. The decline in the crop-producing power of many soils is due to a loss of the partially decomposed animal and vegetable matter known as humus.

"2. The humus of the soil is decreased by the continuous culti-

vation of grain, cotton, potatoes, or any crop with which the land is kept constantly under the plow without addition of any humus-forming materials.

"3. The loss of humus involves a loss of nitrogen which is one of the elements composing humus. The loss of nitrogen from the soil is not always due simply to the nitrogen removed by the crop, but is frequently caused by waste of the humus by improper methods and systems of cultivation.

"4. The humus of the soil is increased by the use of well-prepared farm manures, and by a systematic rotation of crops in which grasses, or preferably clover, form an important part.

"5. The loss of humus from the soil results in decreasing its power of storing up and properly supplying crops with water. Soils with a liberal amount of humus are capable of more effectually withstanding drought than similar soils with less humus. In arid regions the loss of humus from the soil is more serious than in the regions of continuous summer rains.

"6. In sandy soil the loss of humus is most severely felt. In poorly-drained soils, where there is a deficiency of lime, potash, and other similar materials, the humus may form sour mould, but this can usually be corrected by a dressing of lime, marl, or wood ashes.

"7. Humus-forming materials, like the decaying animal and vegetable matters in farm manures, have the power of combining with the potash and phosphoric acid of the soil to form humates which are readily assimilated by plants when acted upon by the proper soil organism. These humates thus increase to a marked extent the available plant food of the soil.

"8. Farm manures and other humus-forming materials are not only valuable for the elements of fertility which they contain, but also for the power of making the inert material of the soil more available to plants.

"9. In soil where there is a good stock of reserve materials, it is cheaper to cultivate fertility through the agency of humus than it is to purchase it in the form of commercial fertilizers."

The value of manures is specially impressed upon the farmer by the above. We realize that manure is the farmer's bank, and the stable fertilizer pile is one of the main supports of the whole business of modern farming.

Constant Cultivation.

I have seen it stated that "In the first ten inches of the seemingly poorest soil in the garden or on the farm there is as much native plant-food stored up per acre as could be purchased for $1,000 in the form of commercial fertilizers." But all this wealth of the soil is locked away from too many farmers because it is unavailable without constant cultivation and fertilizing. Twice a week to work the soil around crops is not too much. Shallow cultivation is sure to conserve moisture, although too deep cultivation is sometimes likely to diminish it. Whether the soil looks as though it needed cultivating or not, it should be lightly stirred often. In fact, dry-farming of which

we hear so much in these days is nothing more or less than the application to the soil of a moistureless land of the same methods by which more favored soils are coaxed to greater yields.

There is only one way to make dry-farming a success. The soil must be fertilized in great abundance each year; this soil must be worked until very soft and mellow, and all cultivation must be done at the proper time. Early planting is always preferable. In nine cases out of ten it will give a larger yield of grain. The same is true of vegetable planting. The writer has known land prepared in this way to yield 50 bushels of wheat to the acre, and from 100 to 110 bushels of shelled corn to the acre, and from 90 to 100 bushels of oats to the acre.

Where stable manure for fertilizing cannot be had except at too great an expense, pure bone meal and muriate of potash, mixed in the proportion of two parts of bone meal to one part of potash, will give excellent results. Several hundred pounds to the acre will be needed, thoroughly mixed and re-mixed through the soil. This last point is a very important one, as the potash carries with it a large percentage of salts which must not come in direct touch with the roots of the plants, although it is of great use in making the soil ready for the nitrogen and phosphorous of the bone-meal. If this mixture is applied evenly over the land, it will not be necessary to apply again for several years. Fish scrap added to the mixture in the proportion of one part scrap to three parts of the fertilizer, will act more quickly in securing an early crop the first season. The salts in the mixture seem to be death to earth worms and grubs.

For light thin soils, and where manure must be bought, bone-meal alone is a good fertilizer for wheat raising. One farmer reports that he bought $24.00 worth of bone-meal for fertilizing his wheat field of sixteen acres. As an experiment he sowed all the bone-meal on twelve acres of the wheat, sowing it with the seed. On the other four acres he used no fertilizer. The four acres yielded ten bushels per acre. The sixteen acres returned 23 bushels per acre. With dollar wheat that farmer made a profit of $10.00 on each acre on the cost of his fertilizer. Other instances, where from five to ten bushels per acre of wheat yield have been added by the use of bone-meal, are many. The grain is better and plumper and can command a higher price, while the convenience of application is apparent. Bone fertilizers contain some nitrogen and more phosphoric acid, with a small percentage of potash, and are lasting in their effects upon the soil. There is a bone fertilizer that is treated with a sufficient quantity of sulphuric acid to make it more immediately available, to which is added a quantity of soluble potash. This fertilizer is known as dissolved bone with potash and forms an excellent fertilizer for a variety of crops.

Wood ashes make an excellent fertilizer for the orchard and garden. They may be spread broadcast over the land or applied in small quantities about the individual trees, bushes or plants. If wood ashes could be had in large quantities they would be great helps to

grain farming. The ashes contain potash, an element that is deficient in most prairie soils in the Northwest.

Nitrate of soda is chiefly a fertilizer for foliage plants, and on other plants it is not good for extensive use. Two hundred to 300 pounds per acre, put on the soil but not on the plants, may be sometimes used. Being of quick action it may be used quite late in the fall on hardy crops—even until after the 15th of September. Some interesting Alabama oat experiments are noted by the Department of Agriculture showing a largely increased yield through the use of nitrate of soda. The average results of three experiments show that fall oats receiving 100 pounds nitrate of soda per acre yielded 14.75 bushels more than the check tests. With nitrate at three cents a pound, and oats fifty cents a bushel, the net profit per acre for the nitrate area was over four dollars, for the grain alone, while the increased yield of straw was a third of a ton. On spring-sown oats the use of nitrate of soda and cotton seed meal as fertilizer was either without effect or actually detrimental.

Bird manure contains a larger percentage of nitrogen than any other manure produced on the farm. According to "Plant Food," a small work published for gratuitous distribution by the experiment farm at Southern Pines, N. C., a ton of fresh hen manure contains 32 pounds nitrogen, 17 potash, and 30 pounds phosphoric acid. Be careful not to use it too strong, nor too near roots of plants.

Leaves make excellent bedding for farm animals and by using them for this purpose they make the stable manure of double value. They can also be used to add humus to the soil by plowing or spading them under in the fall. It will pay every soil worker to collect as many leaves as he can this fall. Those not needed for immediate use should be stored under cover, where they will last for years if kept dry. If there is a wood lot nearby collect a quantity from there also. The leaves from hardwood trees are the best, but those from any tree should be gathered. If your neighbors do not use their leaves, cart them away yourself, if they do not object. Leaf mold is the richest soil of all, and if you stack away all the dead leaves you can get, between layers of soil, they will soon rot down into leaf mold.

Lime a Necessity.

Lime is one of the very best agencies for fertilizing grain and fruit lands. The Genesee Valley of New York, where murl ponds are found from which lime is dug every year, is one of the richest agricultural and horticultural sections of the state. Muck land often needs thorough dressing with lime. Such land often contains iron pyrites, and when exposed to air this oxides to iron sulphate or copperas, and free sulphuric acid may form. Haul out and try what an application of lime will do with it as a fertilizer.

Why is it necessary to use lime? For the same reason that yeast is used in bread-making. Lime is not a fertilizer, but is used to sweeten the soil made sour by the use of chemical fertilizers, and barnyard manures. It also combines with and dissolves the un-

soluble potash, nitrogen, phosphoric acid that is in all soils and makes them available as plant food. After lime has been applied, chemical fertilizers and barnyard manures may be used again to advantage. Constant cropping removes from the soil the lime necessary to properly dissolve these soil chemicals. For every ton of timothy hay you cut you take out of the soil 12 pounds of lime.

One ton of clover		40	pounds	of	lime
" " " wheat straw,		7	"	"	"
" " " oat straw,		9	"	"	"
" " " corn fodder,		11	"	"	"
" " " alfalfa,		50	"	"	"

If you do not keep up the supply of lime in the soil your crop will not grow normally. Have you noticed that you do not get as good crops as formerly, although you prepare the soil just as carefully and use just as much fertilizer? What's the matter? Your soil is sick! Try a little lime and double your crops.

"The Southern Planter" says: "Lime is the one thing that stands between us and famine sometime within the next forty years."

Wood ashes are excellent to keep away some insect troubles. Soot is a valuable fertilizer when scattered as a top dressing around plants, and is also a good insecticide. Fresh manure must not be used on the gardens where the earliest crops are to grow, as it is not immediately available, but must rot first. But liquid manure is excellent. Liquid manure can be made from many substances, but if one wants a stimulator of the first quality and with an even run of available plant food, he should use fresh cow manure in the making. Get a whisky barrel or other receptacle holding fifty gallons or more and to every fifty gallons of water add a half bushel of pure, fresh cow manure and two quarts of soot. Let the mixture stand a few days, stirring it frequently before applying. As the liquid is used add more cow manure, soot and water to keep the stock at about the same strength. This will make a mild stimulant that can be used with beneficial results at weekly intervals. Where a strong stimulant is wanted use half the amount of water.

Manure Spreader.

The manure spreader furnishes the very best way of getting stable manures, or any other fertilizer, distributed upon the soil. One farmer says that "it is as far ahead of the old way of wagon and fork as the self-binder is ahead of the cradle, the thresher ahead of the flail, or the railroad ahead of the old stage coach." This is high praise, but a study of the up-to-date machine spreader of mechanical correctness will show that it deserves this praise. If a man cannot afford to buy a spreader, some method of co-operation with his neighbors is by all means advised.

Any person can spread the manure who can manage a team—children even. The work can be done in one-tenth of the time and be spread so evenly that any other farm machine can go over the same ground. It does not interfere with cultivation, and can be put on after any of the early spring operations, if you haven't time to

spare before seeding or planting corn. You can take out two loads per day as you go to the farm fields for other work, and thus save the farm hours and labor of men and horses. The labor of spreading is so cleanly that clothing does not get soiled. The fertilizer will pay for the spreader in two years at least, by the extra returns in yield that this method of distribution will give, for a small amount of manure will go twice as far and produce twice the results that it did by the old method of hand-spreading.

A large-sized spreader drawn by three horses is much better than a smaller one with two horses. These western prairies call for a big machine that will get over the ground in quick time. They are now so arranged, by improvements each year, that the driver can regulate the quantity to be scattered, and can distribute anything from the coarsest cornstalks to ashes, lime or land plaster. Whatever fertilizer used, it can also be distributed in drills as well as broadcast. The machine can also be used for road-building, or for regular farm work; and where two farmers with spreaders combine forces, keeping the spreaders constantly at work, much saving of time and doubling of results follow.

The manure spreader pulverizes the material finely so that it mixes with the soil better. In a wet season hand-spread manure is thick and bunchy. Some spots will be made too rich, with only weeds and lodged grain, and the average farm laborer will dump unnecessary quantities in many spots, sometimes fifty loads per acre, where ten would do if applied by a machine. With a spreader of 100-bushels capacity, twenty loads can be taken out in a day, as the average time for spreading that amount is about ten minutes for a thin layer.

Manure spreaders for winter use must be very strongly made, or rough jolting over frozen fields will ruin the machinery. Manure spreading in winter is now advocated at the experiment stations as an economy of time and labor when the farmer has the time and labor to spare, and also as a saving of the materials of fertility.

Dry stock feed left in the mangers to bed the stock, is good absorbent for the liquid in the gutters. Liquid manure from a cow is worth four cents a day on a clover field. This is the manure that agrees with the clover plant, and the spreader is the most perfect way of applying it to the clover field. Then rotate on the clover field, corn, oats, wheat or barley, sowing clover again with the small grain in the ratio of about 3 quarts per acre.

President Taft's Prophecy.

These methods of conservation of soil are almost unlimited. The whole question of the fertility of our farms, however, and of our future prospects and possibilities, was pretty thoroughly analyzed by President Taft in his address before the National Conservation Congress at Kansas City, September 25, 1911. He said:

"If our population continues to increase at its present rate, we shall have in 50 years double the number of people we now have. It is necessary, then, that not only our acreage but also our product

per acre must increase proportionately so that our people may be fed. We must realize that the best land and the land easiest to cultivate, has been taken up and cultivated, and that the additions to improved lands and to total acreage in the future, must be of land much more expensive to prepare for tillage. The increase per acre of the product, too, must be steady each year—yet each year the increase becomes more difficult. Still, even in the face of these facts, there is no occasion for discouragement. We are going to remain a self-supporting country and raise enough food within our borders to feed our people. When we consider that in Germany and Great Britain crops are raised from land which has been in cultivation for 1,000 years, and that these lands are made to produce more than two and three times per acre what the comparatively fresh lands in this country produce in the best states, it becomes very apparent that we shall be able to meet the need by better systems of farming and more intense and careful and industrious cultivation. The theory seems to have been in times past, that soils become exhausted by constant cultivation; but the result in Europe, where acres under constant use for producing crops of ten centuries are made now to produce crops three times those of this country, shows that there is nothing in this theory, and that successful farming can be continued on land long in use, and that great crops can be raised and garnered from it if only it be treated scientifically and in accordance with its necessity. There is nothing peculiar about soils in Europe that gives the great yield per acre there and prevents its possibility in the United States. On the contrary, there is every reason to believe that the application of the same methods would produce just as large crops here as abroad. * * * It is now proposed to organize a force of 3,000 men, one to every county in the United States, who shall conduct experiments within the county for the benefit of the present farmers and of the embryo farmers who are being educated * * * and it is hoped that the actual demonstration on farms in the country * * * will bring home to the farmers what it is possible to do with the very soil that they themselves are cultivating. * * * We may properly welcome this plan and try it, and we may look forward to the middle of this century, when 200,000,000 people shall swear fealty to the starry flag, as a time when America will still continue to feed her millions and feed them well out of her own soil."

These are inspiring words with which to end this chapter—and need only co-operation between farmers and the national and state administrations along these lines of soil cultivation outlined here, to make them a practical reality within less than the lifetime of the farmer of fifty or over.

A Recent Instance of Scientific Farming.

Burlington County, N. J., has a farmer who used his brains to develop an old wornout farm of about 300 acres. The farm was sold a few years ago for $31,000, but the purchaser did not use modern methods and the land ran down in value rapidly. In the spring of

1912 it was bought by its present owner for $11,000. In a single season, by practicing intensive farming, the farm has been brought to such a state of fertility, that about 300 bushels of Irish Cobbler potatoes to the acre are now (early fall of 1912) being harvested, and the owner estimates that the net profits of his first crop will almost pay for his farm. Of course this means an amount of fertility put into the soil which will be used for rotating crops for several seasons to come, and will mean not only reinbursement for capital but for the large expenses incurred this season.

CHAPTER III

Things to Know About Fertilizers

A Condensation of the Facts About Soil, As Outlined in the Foregoing Chapter.

For Portions of this Credit is Due "The Garden and Farm Almanac," Published by Doubleday, Page & Co.

A COMPLETE FERTILIZER is one which contains the three essential fertilizing constituents, i. e., nitrogen, phosphoric acid and potash.

Nitrogen exists in fertilizers in three distinct forms, viz., as organic matter, as ammonia, and as nitrates. It is the most expensive fertilizing ingredient.

Nitrates furnish the most readily available forms of nitrogen. The most common are nitrate of soda and nitrate of potash (saltpetre).

Nitrification is the process by which the highly available nitrates are formed from the less active nitrogen of organic matter, ammonia, salt, etc. It is due to the action of minute microscopic organisms.

Phosphoric acid, one of the essential fertilizing ingredients, is derived from materials called phosphates. It does not exist alone, but in combination, most commonly as phosphate of lime in the form of bones, rock phosphate, and phosphatic slag. Phosphoric acid occurs in fertilizers in three forms—soluble, reverted, and insoluble phosphoric acid.

Superphosphate.—In natural or untreated phosphates the phosphoric acid is insoluble in water and not readily available to plants. Superphosphate is prepared from these by grinding and treating with sulphuric acid, which makes the phosphoric acid more available to plants. Superphosphates are sometimes called acid phosphates.

Potash, as a constituent of fertilizers, exists in a number of forms, but chiefly as chlorid or muriate and as sulphate. All forms are freely soluble in water. The chief sources of potash are the potash salts from Stassfurt, Germany—kainit, sylvinit, muriate of potash, sulphate of potash, and sulphate of potash and magnesia. Wood ashes and cotton-hull ashes are also sources of potash.

Manures.

Soil is productive when it has good physical texture, plant-food and a sufficient supply of moisture. Even though it has an abundance of plant-food, if its texture is not good, it will not raise a good crop. The best soil is open, mellow, friable; rather than loose and leechy, or hard and cloddy. Commercial fertilizers add plant-food, but usually they have only a small influence in correcting faulty textures. Therefore, before these concentrated fertilizers are applied

to land, it should be gotten into good physical condition by judicious tillage and by the incorporation of vegetable mold or humus. The leading source of humus in most gardens is stable manure. Manure adds plant food to the soil, and it also improves the texture of the soil. When available no commercial fertilizer need be used, as it is a complete fertilizer as well as a corrector of faulty soil texture. The most desirable manure for the garden and for house plants is probably old cow manure. It does not burn or lose its strength and mixes well with soil and leaf mold.

Beds which are to be used for flowers next year may be dressed with manure in the fall and deeply spaded, leaving the surface rough and loose.

A good fertilizer for house plants is heavy grass sods. The best results are obtained when, after they are cut and laid grass-side down in several layers, 3 to 4 inches of air-slacked lime is sprinkled on top of each layer. This is allowed to become thoroughly decomposed.

Farmyard manure does contain all the constituents of plant food, and it also causes a certain amount of disintegration of the soil. It has a warming effect on cold clayey lands, and retains moisture and ammonium compounds in sandy leechy soils.

Analysis of Manure.

This table gives the value per ton of the three important fertilizing elements contained in various kinds of manure:

	Cattle	Horses	Hogs	Sheep	Chickens
Manure water....	75.25 %	48.69 %	74.13 %	59.52%	56.20 %
Nitrogen.....	.426%	.490%	.840%	.768%	802.000%
Phosphoric acid..	.290%	.260%	.390%	.391%	502.000%
Potash.....	.440%	.480%	.320%	.591%	80.900%
Value per ton....	$2.02	$2.21	$3.29	$3.30	$7.07

It will be seen that three elements, nitrogen, phosphoric acid and potash, are contained in manures to the value of from $2.00 to $7.00 per ton.

Comparison of yields from application of fresh and rotted manure. Yields per acre in bushels:

	Corn Bus.	Wheat Bus.
Unmanured	38.1	16.1
Fresh manured.....	70.7	19.7
Rotted manure.....	65.1	19.1
Grain from fresh manure over unmanured land	32.6	3.6
Grain from rotted manure.....	27.6	3.0
Grain from fresh manure over rotted manure	5.0	0.6

Corn.—Average of 4 crops. Wheat.—Average of 2 crops.

Results of applying fresh and rotted manure before and after plowing. Yields per acre:

Fresh Manure.

	Corn		Wheat.	
	Grain Bus.	Fodder Lbs.	Grain Bus.	Straw Lbs.
Before plowing.....	87.2	6,950	20.3	1,080
After plowing.....	98.1	7,500	22.3	1,160
Grain from using manure as a top dressing.....	10.9	550	2.0	80

Rotted Manure.

	Corn		Wheat.	
	Grain Bus.	Fodder Lbs.	Grain Bus.	Straw Lbs.
Before plowing.....	82.3	6,550	19.8	760
After plowing.....	32.6	6,450	20.7	960
Grain from using manure as a top dressing.....	0.3	100	.09	200

Wheat.—Average of one crop. Corn.—Average of two crops.

Poultry Manure a Good Fertilizer.

Fresh dropped poultry manure is a dangerous fertilizer when applied to vegetation alone, as it contains so much heat. If it is to be used in its fresh state it makes a good fertilizer by adding ⅓ its volume of gypsum, often called land-plaster. To this may be added some common salt. This is then mixed thoroughly together and let stand for a few days before using. Wood ashes and lime should not be mixed with chicken manure as they will destroy the strength by neutralizing the ammonia contained in the chicken manure. Lime is an excellent fertilizer when mixed with barnyard manure.

Wood ashes are a very good fertilizer for lawns and all kinds of grasses. They contain a large percentage of potash and can be applied wherever this element is needed.

Commercial fertilizers vary a great deal in composition and hence in value. Some contain more of one element than another and their values change for various crops. A concentrated fertilizer contains from 1.75 to 3% of nitrogen, from 3 to 12½% of potash and from 9 to 20% of phosphoric acid. There has been more or less fraud connected with the sale of commercial fertilizers, and in purchasing it is not only important to know the percentage of each element present, but to know the percentage available as well. It is cheaper and usually more satisfactory to mix one's own fertilizer if needed.

The Value of Lime as a Fertilizer.

Liming is a very old agricultural practice, and the importance of lime as a so-called fertilizer has long been recognized, although its true value is being largely explained by investigations that are now in progress. As a rule, the beneficial effect of lime has heretofore been ascribed mainly to its action in improving the texture and drainage of the soil, in hastening the decomposition of organic matter in the soil, in rendering the inert nitrogen of the soil humus more available to plants, and in assisting in setting free the potash and other

inert fertilizing constituents of the soil. While all these benefits may fairly be expected to result from the use of lime under proper conditions, recent investigations have shown that it performs other equally important functions in the soil, and that its abundance or deficiency there is a matter of greater importance than it was formerly supposed to be.

It has been generally assumed that there is a sufficient quantity of lime in most soils to meet the demands of ordinary crops. The Minnesota, Rhode Island and other stations have shown that except in limestone regions it is likely to be as deficient as potash or phosphoric acid. Especially is this true of soils derived from the decomposition of granite. In testing the fertilizer requirements of soils it becomes as important, therefore, to determine whether lime is deficient as whether potash and phosphoric acid are lacking. A deficiency of lime may be due to the continued growth and removal of crops without liming, or to leaching out of lime, a process which is continually going on and which is greatly hastened by the use of certain fertilizers, especially muriate of potash. The liberal use of muriate of potash and similar fertilizers on a soil not abundantly supplied with lime should be accompanied by periodical applications of lime.

A deficiency of lime in the soil is accompanied by a state of acidity, or sourness, fatal to the vigorous growth of many crops. The Rhode Island Station has shown that this condition of acidity is widespread even in upland soils which are well drained and not supposed to be sour, as well as in low, wet soils. It was found in experiments in this station with different forms of nitrogen that sulphate of ammonia was positively poisonous to plants on such soils when it was not used in connection with lime. When the acidity of the soil was corrected by applications of air-slacked lime, the sulphate of ammonia was beneficial. This beneficial effect of lime was probably largely due to the fact that the lime restored the alkaline condition of the soil necessary to the transformation (by nutrition) of the sulphate of ammonia into nitrates so necessary to most crops.

Soil Preparation.

Very few soils are in readiness for cropping with the simple plowing of the land. If the best results are to be obtained, the soil must be properly prepared. The treatment of course differs with different classes of soils. The depth of plowing depends upon whether they are sand, clay or loam and upon the depth of the root system of the crop to be put on. In any event a poorly prepared seed-bed is an excellent way to secure a partial, if not complete crop failure.

In breaking new land the mistake is often made of plowing so that the slices are completely inverted. These should be left standing edgewise so that the elements can work on all parts of the slices and disintegration be more thorough.

After plowing, the disking, harrowing, cultivating and rolling must be determined by the character of the soil. The object is to thoroughly pulverize the land. The plow is the most economical pulverizing agent.

Conservation of Soil Fertility.

To ascertain whether or not your farm is being run so that it is holding its own in matter of fertility and not declining, it is only necessary to calculate the amounts of nitrogen, potash and phosphoric acid sold from it and see whether enough is put back to take their place. The following is a table giving the amounts of the three elements per ton of product:

Data from Pennsylvania and Minnesota Ex. Stations.

	M. lbs.	P205 lbs.	K20-Potash lbs.
Timothy Hay	25	9	40
Clover Hay	35	14	30
Wheat Straw	11	4	30
Oat Straw	12	4	18
Wheat	45	20	12
Oats	33	16	11
Barley	40	18	11
Rye	42	20	13
Flax	87	32	14
Corn	32	14	8
Wheat Shorts	48	31	20
Wheat Bran	54	52	30
Linseed Meal	100	35	25
Cottonseed Meal	130	35	56
Milk	10	3	3
Cheese	90	23	5
Live Cattle	53	37	3
Potatoes	7	3	11
Butter	1	1	1
Live Pigs	40	17	3

Rotation of crops and diversified farming are the most successful ways to retain and increase the fertility of soils as well as increase the yield of products. By keeping cattle and feeding them the fertility is returned to the soil, as has been explained in a previous chapter.

Prof. Harry Snider, late of the Minnesota Ex. Station, gives the following principles involved in crop rotation:

1. Deep and shallow rooted crops should alternate.
2. Humus consuming and humus producing crops should alternate.
3. Crops should be rotated so as to place the weak feeding crops before the gross feeding ones. Thus do not follow clover and timothy with mangel but rather with flax.
4. Crops should be rotated so as to secure nitrogen indirectly from atmospheric sources and to promote desirable bacterial activities in the soil.
5. Crops should be rotated so as to keep the soil in the best mechanical condition.
6. In arid regions crops should be rotated to make the most use of soil water.

7. An even distribution of farm labor should be secured by a rotation.

8. Farm manures and fertilizers should be used in the rotation where they will do the most good.

9. Rotations should be planned so as to produce fodder for stock and so that every year there will be some important "money crop" to be sold.

Making Straw Pay.

This is the way a Missouri slope farmer is turning his straw into dollars. As he tells the story it runs as follows:

"I raise grain for the straw, for during the past 10 years I have made more clean profit from feeding the straw to stock than I have from the grain. A few years ago I got hold of $25, took it to the bank, deposited it, took a check book and started out among my neighbors. Whenever I found a yearling for sale I bought it if I could, giving a check for $1. After I had the stock purchased I went back to the bank, mortgaged the cattle and finished paying for them. I got the stock home and fed them wheat straw when they could not rustle; when the wheat straw was gone I fed oat straw; when that was finished I fed hay until they could go on pasture.

"Many of those long yearlings I bought during the winter I sold the following fall for twice what I had paid for them. I have followed that plan for a number of years. When I had an abundance of straw I let the stock run to the stack, and if I was short I fed it out. The most of the work with my stock has been during the seasons of the year when I could not work at anything else.

"And here is another thing for you fellows to think of. I've put more barnyard fertilizer back on my land than any farmer in Morton county. My plan is to fall plow part of my land and after it freezes up I spread with a manure spreader six loads per acre. This will not leave it so thick but that a drill and harrow will work it nicely. That means more grain and more straw for the next crop."

CHAPTER IV

The Business Farmer

"IN preaching, teaching and farming there is less opportunity for and less to be gained by dishonesty than in most other vocations."

The farmers who have been most successful in all the branches of farming are those who have had a large amount of practical experience. The only way a thorough knowledge of agriculture can be acquired is by working out the great farm problems, each man for himself. This is admitted by those who have been very successful farmers. The most thorough education acquired in the best colleges of our land is only a fraction of what the average man should know to make life a success. There is no school or college in the land that affords so much of varied instruction as does the farm life, or where the impressions are so lasting and strengthening to the mind, yet in a vast majority of cases the man who has a trained intellect will make a better farmer, and farm to a better purpose than will his uneducated neighbor.

Country Life Commissions.

Since the report of the Country Life Commission appointed by former President Roosevelt, there is already to be seen a new farming movement in the West and Northwest. In fact, it reaches to every part of the country, and the city, waking up to the fact of how much the progress and comfort of the city dweller depends upon the preservation and extension of scientific farming is co-operating more with the idea of conservation of country life. Cities are appointing country life committees, and the states of Washington, Oregon, Idaho and Montana have already "State Country Life" commissions. New Jersey recently held the first country life meeting ever held by the state in the interest of ideal modern farming as a national idea. Massachusetts has had a state movement for some years which works with the state agricultural college along the idea of betterment of farm conditions. Minnesota and Wisconsin are working steadily toward systematic union of all farm societies that have the idea of business farming as their base, for in the Middle West has been the place where the business farmer has become a chief factor in feeding the world for more than a half century past.

The large farms and ranches of that section have done much to show what can be done by farming on a large scale. They have given an immense amount of business to the cities in the way of farm implements of all kinds and of building materials. High grade stock has been bought. Fancy poultrying has introduced entirely new ideas into the care of even the common hen. The breeding of the best blood in horses, cows, sheep and hogs has improved the whole science

of veterinary care, and lifted the profession to a new dignity. The fences for millions of acres have called for special attention. Stock must be shipped back and forth and products find a market.

All these needs for the large farms have brought an immense addition to the demands upon the transportation facilities of the country. In answer to that demand the railroad systems of the far West and Middle West have grown from 9,021 miles in 1850 to over 200,000 miles in 1910. Between 1880 and 1890 70,000 miles of railroad were built. Statistics show that this was as much as had been built in the 50 years before that by three leading countries of Europe. And it was largely built to meet the wants of emigration to the western lands where the settlers were opening up the farming and grazing sections and making bonanza agriculture.

But now railroad construction goes on much more slowly. The big farms are broken up into smaller ones—still large enough to be estates. Small farms are growing up in irrigated lands and calling settlers there, but the need for rapid railroad construction has passed, and with it the era of high transportation rates. Farmers can now, by a system of co-operation, control this question to a considerable extent. But with this advantage, has come also the present era of combinations of the control of farm products which has threatened to be as disastrous to profitable farming as was that of the railroads twenty-five years ago. In the struggle that has followed the business farmer will not, however, meet his Waterloo at last. For now he has the nation enlisted on his side. No matter what "parties" come into power, the day of high prices has ranged the farmer and the consumer side by side in the economic battle, in which the "special interests" will go down.

Economical Farm Management.

The first thing the farmer must put his business foresight into is the question of the most economical management of his acres. When some of the wisest men of the country are pointing out the leaks in our business enterprises, it is surely time for our farmers to study frugality in farming, and the most efficient methods of getting marketable returns.

What may be saved by a careful attention to strict economy on the farm happens to be extremely well shown by the words of a Minnesota farmer of my acquaintance. He was asked to give his experience in agricultural economy for the benefit of a western farm journal with a large circulation. I quote verbatim from his letter to that paper:

"Some intelligent farmer should compile statistics that would show in actual figures what is ordinarily lost on four farms out of five. Although I have not kept strict account I give here some general information that may be of interest. From September 1 to January 1 of each year I never have any hog feed; that is, I never store it up for that period but rely on wasted grain for that purpose. In the first place I have a woven wire hog pen, just the size of my stock yard, which I move after threshing so that it will include the

old stack yard and straw pile. It can also be removed to any field where the crop has not been gathered by reason of hail, frost or rain. Then after the stacking is done I go over the fields carefully and pick up stray bundles—everything that will feed man or beast. Possibly this makes the scientific farmer smile but I have never yet done this without at least one grain stack to show for my two or three days' work. This year so far I have a good big stack and a half from 180 acres, and have 120 acres left to work over. On one 12-acre patch that a renter had stacked, I secured three big loads of oats, which means a trifling sum of $30. About half of this is fit to thresh and market and the other half goes to the pigs. The man that rents this place hasn't a milch cow, a chicken, a pig or an overcoat on his place, yet $15 (his share of the oats) looks smaller than three hours' work to him. A man can live in any township where there is a strong proportion of renters and each year buy the privilege of that class to glean their fields and feed more hogs with the gleanings than the state legislature's appropriation bills number."

I have known two young men who were good examples of the successful and unsuccessful man. Each had a good common school education. Both began quite early to do odd jobs for a few pennies. But one of them had the good or ill fortune to inherit several thousand dollars from a distant relative. The first large remittance of his inheritance sent to him looked like an inexhaustible mine. He married, set up a pleasant home, plunged to a considerable extent in the gambling ring and was becoming quite a source of gossip for his manner of living when the end of his resources came. He had spent his whole inheritance and went back to work at his trade.

The other man, who had nothing but his own industry and ability to depend upon, probably felt envious of his friend's fortunate chance, but he kept on at his work. From picking berries he went to selling eggs on a small margin. Then he sold butter and eggs to the employes of the coal and fruit trains on the railroad until he was able to get a training at telegraphy and a position as night operator at a railroad station. From here he went into business and though now a little past 30 he is independent and lives in a pleasant home past which the windfall man goes every night and morning to his day's work.

The former had formed the habit of saving, and no matter how small his income he never lived up to its limit, and he invested his savings wisely. It takes self-denial and perseverance to stick to this resolution—but after the first few years the reward begins to appear and the art of living becomes easier. But don't lose your head then —for ten thousand dollars lost at 35 years is far worse than one thousand at 25 years. The more capital a man has the greater need that he shall not put all his eggs in one basket when he makes a business venture.

Labor-Saving Tools and Methods.

Book farming and practical farming must go together in future. The study of soils, the diseases of plants, the principles of veterinary

science and the care of the dairy are especially studies of great economic value to the young farmer. Let him get all the help he can from agricultural books, papers and bulletins, and above all, let him get the necessary outfit to farm with all the labor-saving devices possible. Besides his team, wagons, harness, small tools and absolutely essential household and barn equipments he will need a walking plow, gang plow, disk and spike-tooth harrows, drills, binder, mower, rake and, if he can possible manage it, a manure spreader and gasoline engine.

Tools should be kept clean. If the season's rush prevents this it should be attended to in the fall. A little cleaning then, and coating the metal parts with a mixture of oil and rosin to prevent rusting will save a good deal of outlay by and by. After this is done all the tools and machinery should be kept in a perfectly dry place and so arranged that any article can be found easily. Most tool houses are not well planned as to getting tools and machinery in and out.

The question of motor power on the farm has become more of a necessity, instead of less, since the large farms have been cut up into smaller ones, and the big ranges have been divided up into stock farms. Some power for pumping which will be systematic and regular, as need demands, is required; and while the windmill has been an excellent servant in this respect and for windy localities will continue to be, the gasoline engine is more reliable for emergencies, for cold weather or for prolonged periods of no wind. In fact, no power is so suitable, from the points of immediate readiness, facility of action, and economy of fuel. A gasoline engine costs but a little more than a windmill.

However, many farmers cannot as yet purchase a gasoline engine. But they can still use the old-time tread power. The modern treadmill has a level tread, thus making it easier for the horses, especially if they are gradually accustomed to the action of the tread, and no one team is kept at work ever for a whole day. An automatic governor is supplied. This power is not used so much as it should be in the Middle West, largely because of the wider advertising given newer powers.

Another point; with the present increase of land values do not buy scrub stock for a valuable farm. Improved cattle will bring prices to match the acres and cost no more to keep than mongrels. Buy few to start with, but have those of good quality. Don't pay too much attention to pedigrees. Then weed out poor females each year and retain valuable ones.

Keep Farm Accounts.

In order to know how you stand, especially on the stock question, keep a regular system of accounts. If you haven't time to do it yourself, get your wife to do it. Or, if she hasn't time either, let the boys on the farm keep the accounts of the business. If you have no boys, set the girls to work at this. January is a good month in which to take an inventory of the previous year, and below is given a simple

form, as a suggestion only, which first appeared in the Canadian Thresherman.

Inventory for year ending ....

RESOURCES.

Acres at $..... per acre	.....	.....
Acres at $..... per acre	.....	.....
Buildings on above valued at	.....	.....
Wells, towers, tanks, pumps, valued at	.....	.....
Fences, etc., valued at	.....	.....
Machinery valued at	.....	.....
Wagons, buggies, sleighs, valued at	.....	.....
Harness, valued at	.....	.....
Bushels Wheat at $.....per bus.	.....	.....
" Oats $..... "	.....	.....
" Barley $..... "	.....	.....
" Flax $..... "	.....	.....
" $..... "	.....	.....
" $..... "	.....	.....
Tons Hay $.....per ton	.....	.....
" Straw $..... "	.....	.....
Head Cattle $.....per head	.....	.....
" Hogs $..... "	.....	.....
" Horses $..... "	.....	.....
" Sheep $..... "	.....	.....
" $..... "	.....	.....
Poultry, valued at	.....	.....
Accounts due from others	.....	.....
Cash on hand	.....	.....
Cash in Bank	.....	.....
Total resources	.....	.....

LIABILITIES.

Due on Land	.....	.....
Rent due	.....	.....
Due on Buildings	.....	.....
Due on Machinery	.....	.....
Due on Notes	.....	.....
Due to Bank	.....	.....
Estimated Depreciation	.....	.....
Total Liabilities	.....	.....
Total Resources	.....	.....
Total Net Worth	.....	.....
Net worth previous year	.....	.....
Profit for year	.....	.....

The use of the automobile on large farms has been an accepted fact for some time. But its value for truck farmers living near large cities will be also demonstrated more and more as its usefulness and speed in getting garden products to market becomes more practically applied. The application of the motor power of the machine for stock watering and dairy purposes is only another instance of the labor-saving and time-saving uses of the auto in modern farming.

The Standard Oil Company, in league with the liquor law, seeks to bar the farmer from liberal laws as to the manufacture of denatured alcohol on the farm, thus preventing him from using alcohol for power and light; but the growing independence of the farmer as a voter has helped to check the dangers from these two powerful interests. Try that same voting power to influence legislation which shall bring the farmer more than a fraction of the dollar paid by the consumers of his product.

CHAPTER V

Own Your Farm

IF it is possible, by all means, own your farm. Should you find it necessary to lease at first, always keep before you the one aim of finally being the owner of the land you till. Leasing, undoubtedly, has many points in its favor, and to many prospective farmers it is the only course to pursue for the first few years. In either case, whether you buy or sell, be sure that everything is done in a business-like manner and that the papers are all legally drawn up. This will save trouble, annoyance and possible expense later on.

When buying, look for a location where there will be wood for fuel and other purposes, good water, a congenial neighborhood and good market advantages.

If you have but little capital when you buy, 50 acres well and intelligently cultivated will probably yield proportionately more clear money to the acre than will your neighbor's big farm of two or three hundred acres; he has to meet the problem of help and the waste that is more likely to follow where a large farm must be cultivated.

The first item, that of hired help on large farms, cuts down the amount of profits greatly. The supply and quality of hired farm labor has been growing less and poorer for years. The farmer often gets no fair equivalent for the wages he must pay, and therefore is often forced to extend the hours of labor in order to accomplish results in special seasons. This is all wrong and between the three problems of interest, taxes and labor the day of the large farm is doomed. Intensive farming also has become more necessary as wheat and grain farming begin to show the natural results of run-out land. The next generation will own small farms clear of debt and these farms will be worked by the labor of the family, aided by machinery, to a great extent, unless the demand for combination at last brings the farming community into a national farmers' union, where labor becomes a factor to be shared in emergencies, as our pioneer grandfathers learned to do.

Time Is Money.

In selecting your small farm with an eye to securing as good a soil as your chosen locality furnishes, don't think too lightly of your own future labors, because you are now young and strong. If there are poor spots in the farm that a very little outlay will make fertile, don't consider this a great drawback, providing you can get your farm cheap enough. A man's youth is his capital, however, and he wants it to bring him a good interest without the necessity of a 16 or 18-hour day of labor. There are farms where the hired man is

expected in busy seasons, to rise at 4 a. m. and to go to bed at 10 p. m., sometimes 11 p. m. What wonder that laborers will not go upon farms to work when in all cities now a day's work is from 8 to 10 hours? If you cannot make a success of farming by averaging a day's work between sunrise and sunset, try some other way of getting a living, for you are not a business farmer. You are living on your capital, living wastefully on it, but you are not making a living. You are using up life at both ends.

Therefore if you must spend several years in getting stones off your land, draining marshes, or stumping, be sure that the price of the land is low enough to figure out a fair profit for your five years or so of preparatory work. It is good financiering to pay $50.00 for a thing that requires $50.00 more outlay to make it worth $106.00 provided you get quick returns. But remember again that time is money.

You will probably be in debt for a part of your farm. Not many farmers begin without some incumbrance, but that is not of so much matter if you keep your credit above question. In 1890 more than one-half of the farms of the United States were operated subject to mortgage or a landlord. Between 1890 and 1900, however, this proportion was greatly decreased. Be prompt in meeting all financial obligations, and as to credit, so long as your yearly balance sheet shows that your land is increasing in fertility don't worry too much over what you owe. But don't begin your credit system at the stores of the neighboring towns or cities. When you go to the market town with produce always take home more money than you took with you. People will soon begin to regard you as a "safe debtor," if you prove that you mean to end by being a safe creditor.

Three Classes of Farmers.

Aside from the speculative farmer, who runs his "estate" from a distance, the working farmers of this country can be put into three classes. There is the slovenly one, who wears his clothes until they will stand with dirt, reeks of the stables, and keeps his home and surroundings as slovenly as himself. Don't belong to his class.

How about the miserly thrifty sort? He cares little for the outside world, eats what he can't sell in town, and is always increasing his gains. Does he ever spend any of these gains in making life happier and easier for his wife and children? Do Sundays and holidays mean anything but more chances to work and glean when other people are not working and gleaning? Don't belong to this class.

The farmer's life ought to be one of the happiest of lives. Make it your first resolve, after the resolve to pay your debts, that you and your family will get some comfort and happiness as you go along. I put the debt-paying first because no honest man can be happy unless he is paying his debts. But while you are doing this, give your wife a comfortable home before she is so worn out that she cannot enjoy it, and see that your children have the children's rights of growing up through a happy childhood.

To this third class of farmers, a constantly increasing one, belong the prosperity and class dignity of the farmers of the United States. Such a farmer has time for work and play and money for both. His mile farm is paid for, his stock well fed and housed, his farm machinery protected, his buildings kept in repair, his family well provided for and educated.

He believes in God and man. And why? Because he has been self-respecting enough to make the best of what God gave to him to start with; youth, health and strength. Through these three natural forces of the world he has gained control of land, labor and capital—the three other sources of power. This kind of a farmer is the one who is steadily helping on the agricultural cause and is making an effective stand against that power of capitalization in cities which is bringing us dangerously near the proprietary landlordism of the old world. If all farmers realized what a power our ten million and more of farmers might be toward the betterment and financial encouragement of their class there would be far less dissatisfaction with the farm and its life.

Organization.

Farmers need to organize more, not only to protect their own interests, but to improve neighborhood conditions. Unite together, not for grain elevators and for grange banks, but in a general system of co-operation in all rural matters. Make such a system national in its scope and it will do more for the children of the present generation than all the probate courts can give them when this generation passes. The farmer's prosperity means wealth to the people. But at what an unnecessary cost of agricultural time and labor is that national wealth gained. Somewhere between "the man who understands the farmer's needs" so well—(just before election!)—and the man in the distant city who fixes the market price for the products of the farm, the farmer's own prosperity is too often lost. As some one says, cinch bugs are not so fatal to the crop as are these two agents.

So far every step toward better market returns has been chiefly one of theory. But progress in organization among farmers has been slow and conservative—and probably that has been the safer way. Agitation is beginning to count now, however, and within the next ten years the farmer will see a more equitable relation between production and profits. Let him keep on in his resolve to apply the best business methods to the marketing of his products and the same organizing methods of control that are now used in all other lines of work and he will find that he will at last get his just share of his yearly harvests.

One very great aid in establishing the unity of interests and organization of a rural community lies in those days when the farmers get together for social reunions. Make these occasions frequent ones. Get away from the grind for a half day, a day, or a week. Try occasionally a camping-out party, travel, get a chance to meet the faces of your neighbors in a new atmosphere.

Grow the woodbine around the schoolhouse on Arbor day. Carefully plant trees and protect them from stock. Most country schoolhouses stand alone without shade of any kind. The days when country festivals bring the neighborhood together might well be given to tree-planting. The elm is one of the best for shade and permanence, and for varying localities. Take the precaution to protect these trees by making an enclosure of four boards 6 feet long, 2 inches wide and 1 inch thick. Set these about the young saplings at about four to five inches distance from it. Wind these boards from the ground up with barbed wires set closely together, and you will have a protection that will keep away all young animal stock and quite likely young human stock.

Plant roses, wild or cultivated. Get the boys and girls to raise flowers. Five cents worth of seeds bought by each child in a family will give a variety for several individual beds. In this way the small country school can help greatly in the training of farm boys and girls in agriculture. For weakly or delicate children one of the best health restorers is to work in the soil a portion of the day. Give the children each a plot of ground and show them how to use a hoe, rake, trowel and watering pot. Don't tell them too much how to grow things. A little specific detail at the right moment is much better than a whole discourse at the wrong time on potatoes, sweet corn, peas, radishes or lettuce. Let them plant slips and repot flowers, transplant and prune, do grafting and make grafting wax. They can learn the use of the spray also—and how to use manures and fertilizers and the special value of each kind of fertilizer, as well as the choice of seeds and the various methods of sowing them. Thus the home or school may be made very beautiful and attractive to the child.

Not long ago a Minnesota town offered, at the time of its street fair, prizes for beautifying home surroundings. Photographs were taken in July or August and prizes were awarded accordingly. All state fair associations ought to follow this hint. A few hundred dollars distributed yearly in prizes for the best grove of planted trees or for the best planned landscape gardening would stimulate every farmer to beautify his home, and if the children could be induced to share in this spirit of emulation what a difference it would make in the general attitude of the next generation toward farming. The country dweller gets too little out of his country life. Why not a saddle horse? Even if a man is getting toward 40 or 50, so much the more need of one. As for his children, every little boy and girl likes to have for his or her very own, a pony to ride or drive as fancy may dictate.

Give the Children Pleasant Memories.

Those parents who have the happiness and contentment of their children at heart and feel that they can afford a pony, should provide them with one that is both strong and gentle. He should be strong enough to carry two or three of the children on his back at one time or to draw a cartful of them. Too often, particularly on the farm, everything of this kind is sacrificed for a new barn or more land and

the children grow up with no pleasant memories to bind them to the farm. Usually all they can remember of farm life is its incessant drudgery.

But simply giving them the pony is not enough—they should be taught how to care for it; how to keep the stall clean and wholesome, how to groom it and the art of oiling his mane and tail and the necessity of doing these things often and regularly. The pony's stall should be warm, roomy and light and provided with a thick bed of straw at night. This care will make the children and pony fast friends and at the same time the children will be learning valuable lessons.

Ponies like apples and sugar and will soon learn to expect something. If you will, for a few days, have some dainty about you to give them, they will quickly begin to smell around and will get a bite of the apple you chance to have in your pocket, if you do not look out.

Ponies require about 3,500 pounds of hay in a year. Oats, two quarts, and wheat bran one quart mixed together is a good feed for a pony for one day. Also give him a little salt and charcoal mixed together and put in a box, nailed to the side of the stall, where he can help himself. Do not feed green grass, unless well cured, while feeding dry grain and dry hay, as you often bring on colic by so doing. A small quantity of finely sliced carrots is good to feed at times. Sods, cut in the fall, about one inch thick, and put in the barn, are good to be placed, a little at a time, in the stall in winter, where the pony can nibble at leisure.

Inspire Your Boys and Girls For Right Farming.

In this way you encourage your children to do that which they like to do, at an early age, and thus help out the normal inclination toward making an honest living. Don't discourage your boys, especially, in any enthusiasm for any department of farm life. If the father talks about the farm as a place to get away from, if he dwells upon the easy life "those city fellows" have every time he comes back from a trip to town, his sons will be very likely to catch the same spirit and fail to see the possibilities of modern farming. The best sign of the times today for the farm life is that the boys and girls who go to our agricultural colleges go back to the farm when they graduate. The farm, its fields and its livestock, its crops and its fruits have to them become great laboratories for study and for a life of pleasurable activity. Give your boys and girls the right enthusiasm for country life even if you cannot give them a course at an agricultural college. But give them the latter if you can possibly manage it. And when they come back from it, don't criticize or hamper their new-fangled ways of farming. Your children can always teach you something new if they are wide awake boys and girls.

Therefore don't always expect them to look at life as you looked at it when you were young. The world is moving faster and faster, and the present generation is a century ahead of the days of the Civil War. Do your very best to look at life from the viewpoint of this

Twentieth century—for this is to be the century of the greatest agricultural advance that the world has ever known. That intelligent farming pays and pays well is evidenced by such instances as the following:

"Twelve years ago W. B. Williams secured a homestead of 160 acres from one of the first settlers in that district (Yakima). At the time such claims were selling at $250 to $500. The land was left in sagebrush until three years ago, when it was cleared and planted. There are at present 80 acres alfalfa, 35 acres in clover, 22 acres in orchard of pears, apples, peaches and cherries, and one acre in grapes. An offer of $400 an acre has been refused for a portion of this farm. Hay has been the money producer on that Kennewick place. The total yield for the last season was between 600 and 700 tons. Timothy gave a return of six tons to the acre. That hay is in demand at $15 a ton. Mixed clover and timothy sell at the farm for $15 a ton. Alfalfa is the standard crop and ranges about $10 or more a ton. It is easy to figure out how that farm is worth $50,000. It was only a desert four years ago. The crops have paid the first cost of the land and water, fencing and improving, and left the land complete to the owner. Next year the orchard will begin showing results.—Seattle Post-Intelligencer of 1909."

Get as many books and magazines as you can for the home reading table. In these days of 10-cent periodicals—and even good 5-cent ones—a few dollars will go far toward keeping the boys and girls at home. Give them games for indoor and out. Entertain their friends, or let them entertain them. Talk farming intelligently and cheerfully before these different groups of young people, and encourage in every way a sane and progressive spirit of co-operation in country life among practical farmers. In this present century your children must fight their way and bring the farmer's world closer to the gates of many avenues of culture and refinement that now seem distant. Only organize; the family first, the neighborhood later, the county next, and finally the state, and you will secure a mighty agricultural uplift that will fill our senates with as many or more farmers than there are lawyers at present.

Let me add here, if you want to make the most of your neighborhood and its chances of co-operative life, speak well of all, especially of women. I knew a young man of fine education who was a candidate for superintendent of schools for his district. The opposition candidate was a woman of ability and brains. The district comprised two large counties with a decided Republican majority. The man was the nominee of that party and his chances for election were practically sure until he lost them by one foolish speech. He called at a house, during his electioneering campaign, where a woman was washing. "There," he said to one of the party, "that is the place for women—at the washtub." Very likely the young man only meant that home duties should occupy women, but the speech went like wildfire over the counties, and he lost the election.

A Fresh Air Outing.

The time is coming when hundreds of thousands of city people will be living in the country to breathe God's pure air. My city friends, there is nothing that can surpass the well-kept farm for a home. From its beautiful lawns, where flowers shed perfume, to its orchards of trees and vines loaded with rainbow colored fruits hanging on the branches and vines in abundant reward for the summer's sunshine, the farm is the fulfilment of what the garden of Eden first promised to man and woman—a home for the shelter of the family life. I often think of the children of New York City to whom I gave the freedom of my orchards on the occasion of a "Fresh Air Outing." The children from 6 to 8 years old were stationed in the neighborhood of my New York farm in the center of New York state —and some seventy-five of them came, at different times, in small parties, to eat apples from my trees during their three weeks' outing. Like colts turned loose they frisked around what was a paradise to them in the time of apple feasts. When they left, the children gave me three good rousing cheers, and the girls took off their bonnets to match the boys' doffed caps and hats. Roaming over the broad acres and through the evergreen forests mixed with the giant sugar maple they spent hours of happiness. They got more of the joy of "living on the farm" than many regular country dwellers could who are just farming to live. Many of them had never seen apples under a tree before and did not know whether they grew on trees or bushes. The apples had ripened and dropped to the ground where good and poor lay together—many bushels of them. There was a great scrambling among the children and the excitement was catching. Filling their dress skirts and coats with all they could carry the girls and boys said they should carry as many as they could "home to mother," remembering that "mother" always took home something for them when away.

CHAPTER VI

Farm Buildings

UPON the hill the white house stands,
The maple grove and fountain;
The green hillside and meadow lands,
And distant sunset mountain.
The sunny slope, the rock, the tree,
Where childhood freely wandered;
The apple bloom and humming bee,
Past scenes now often pondered.
The orchard near, where oft I strayed,
With father, gathering apples,
And homeward drove the lowing herd,
The red cows and the dapples.
I see again the cider-mill,
The juicy apples grinding;
The nest-of eggs beneath the sill,
Our mother praised for finding.
The half-way rock, moss-grown and old,
The guinea's nest beside it—
Her foolish mate the secret told,
While she strove well to hide it.
I call to mind the soft spring days,
The hillside and the mowing,
The may-flowers by the wooded ways
Their pretty faces showing.
I hear the blackbird's roundelay,
The sparrow's joyous trilling:
The woodland rill sings on its way,
My heart with music filling.
The bird, the flower, the forest tree,
The squirrel in the wildwood;
In memory's glass again I see,
As once I saw in childhood.

—Author Unknown.

THE farm home is too apt to be forbidding or unattractive in appearance. In traveling about the States and Canada I have seen buildings painted either in gloomy or in too gaudy colors.

It costs no more to paint a house in cream-white or neutral tints of gray-green or brown that will blend with the natural colors of fields and woods than it does to daub it in bright reds, or pinks, or vivid greens.

Select or make a slight slope and put your house upon it. If the slope has a grove of trees as a wind-break from the prevailing winds,

House at Merriam Park, Minn. Note the construction of stone work on first story, this extends to basement foundation. Very economical as to fuel in cold weather, and cool in warm weather. An ideal farm house.

so much the better. If not, then to plant a large thick grove of elm trees, soft maple, or similar hardy native trees will pay better than any grain crop that can be raised on the farm. Such a grove is a very profitable shelter for the stock-barn also. Mulch heavily with straw when you plant the young trees, and continue this for four or five years and you will soon have a fine acreage of young forest.

House Plans.

Plan your house so that you can begin with a small building at first, and add to it later on. Build with an eye first to kitchen conveniences for your wife, as a large share of her days will be spent in that room. Have also a good sized family room for yourselves and your friends and two good, airy sleeping rooms to begin with. Such a cottage with the necessary closets and pantry will make you a comfortable home for a few years. A house like this can be built at a very moderate expense by cutting out all but the necessities of good construction, and by putting your own labor into it, with the aid and supervision of a good carpenter. What you build, build well and for the future. Then you will be ready to turn your attention to other matters, feeling that your wife and growing family are comfortably (if not elegantly) housed.

Make your own drawings, to the scale of one-fourth of an inch to one foot. Decide on the studding thickness and add one inch for lath and plaster on each side of partitions; and one inch for sheathing and for siding on the outside walls. The nearer a house is to a rectangle or a square the cheaper and more solid it will be. Submit your plan to an architect and get his advice. If you can possibly do so let him make you working drawings and prepare the bill of materials. But be your own boss, even if you let the contract for all or part of the building. Then you can reject material not up to contract. By a little attention to details and only a slight additional expense the building of a simple house may be made artistic and attractive. The foundation can be quite high, at least two feet above the ground, and the stones can easily have a rock face put upon them by a hammer and chisel. If it is not possible to afford a roofed porch on your house, or if you wish to get all the sunlight you can in your home, a well built and wide foundation porch floor on the front or the front and sides of a house need have only a pergola top and columns. On these columns climbing vines can be trained, as one's taste or purse dictates.

An open fireplace is the ideal ventilator, and where timber is on the farm, is one of the cheapest ways of heating rooms in all but below zero weather. The writer knows of a case where, for twenty-five years, no difficulty was met with in heating a living room by a small fireplace every month in the year that a fire was necessary, except January and February, and this in Minnesota. Cannel coal was burned here, but only because it was cheaper than wood. Dry wood would have done as well. But you must have a good chimney.

Cellar and Cistern.

The cellar of such a home should be made the full size of the house. Don't save on your foundations. Let the foundation walls go to the bottom, and in order to keep the cellar perfectly drained, lay the first course of hollow tiles, put in end to end. On the lowest side lay a tile drain to connect. Cement floors and cement walls (if you can afford this last expense) will give you a cellar that will outlast any improvements you may add to your superstructure as the years go by. A few inches of cement will answer all purposes as to thickness.

You will want a cistern and this should be planned large enough to meet all future needs until you can put in your own water system. If a part of your cellar is set off for a cistern and cemented, you can plan your foundation with that end in view, extending a corner of it out for that portion of the cistern into which the rain pipe will flow. The part of the cistern under the house should have a filter wall between it and the inlet portion. This will give you pure soft water for domestic use, which can be used for drinking purposes, also, until such time as you can install a safe water system.

Arrange your cellar also for a furnace, even if you do not introduce one for a time, and see that your chimney details are built for that purpose. The furnace room can be used for storing wood and for a vegetable cellar, also temporarily. Let this room be planned, if possible, so that it is next to the cistern compartment, in order to temper the air better. Very few farmers as yet have their own ice house, so that the cellar will have to do duty for fruit, milk, butter and all food that must be kept at a low temperature. This is a poor method for saving labor, but for the young farmer and his wife, who too seldom remember that their strength is often their only capital, it is the favorite way. Therefore, partition off a room near the cellar stairs for this use. You will want a laundry later on. See that a place for that is included in your cellar plans.

A well planned cellar, therefore, is the first need of your house. When you have fully satisfied yourself that your basement floor will be equal to the demands of a better style of living than you can now afford, and perhaps cannot afford for a good many years, it will be time to think about the floors above.

Wood being still the cheapest building material, you will probably build of wood. It will not be necessary at first to complete your second story, as all the rooms I have mentioned as necessary can be planned for the first floor. Later the two bedrooms can be converted into dining room and large pantry if properly planned with that idea in mind, and the sleeping rooms will then go on the second floor. With this simple home in which to start, even the farmer who goes into debt for his farm can feel that he is ready for the future and comfortable for the present. Such extra expenses as are involved by porches, a heating and lighting system (an acetylene gas system can be installed at small cost for lighting), a laundry in the cellar, and a water plant for all the farm buildings can be undertaken later.

Stone Construction.

However, these suggestions are for that large body of farmers who must study economy in every way when starting out. There are other ways of building farm houses. An authority on farm building advises stone houses for the farm, even at first, and declares that, though stone houses cost a little more, they are the cheapest and best in the end. I give his directions for building such a house as they were written out for this work. Of course cement could be used instead of stone, but cement construction is still in its infancy, and improved methods, together with increased competition, will probably decrease the cost of cement work as time goes on.

"Stone houses and stone barns are the best kind of farm buildings, if built right. The walls should be from eight inches to two feet thick. No stone should go through the wall above ground. The house should have an air chamber from four to six inches inside of the wall, with studding for this air chamber of two by six. This leaves the space between the stone walls and the lath and plastering six inches so that no dampness from the stone wall will ever affect the lath and plastering. The air chamber can be any width desired, of course. If the house is built with two air chambers and a brick lining, it will be still warmer. In this case the outside stone wall should be from 10 to 12 inches thick, and the inside wall should be faced up with a brick wall 5 or 6 inches thick, with a half inch air chamber between the two walls. There should be another air chamber between the brick wall and the lath and plaster."

Such a house will cost 20 per cent more to build than a frame house, but it will be much easier to warm and will cost much less to keep in repair. Where the stone is to be found on the farm in the shape of large boulders or rocks, these make the best of material for stone construction when broken and laid with the round side out. Or they can be used for the lower story with cement or frame for the second story. Not half enough use is made by many farmers of the materials they have to their hand on their own acres. Such farmers are often the ones that are always complaining about there being nothing in farming.

Sanitation and Beauty.

After the house is built, however, with all due care to sanitation, light, sunshine, heating and ventilation, it will need just as much care to keep it sanitary. One of the first needs of good housekeeping is to keep the cellar aired thoroughly, and the soil sweet around the house, especially near the fresh air intake to the furnace. Dishwater or slops of any sort should never be thrown around the doorway. They are very useful for occasional applications to the flower and fruit garden, but are not meant for daily watering of your front or back yard. The soil will become sour and ill-smelling, and need applications of lime to make it sanitary again.

Every farm house can have a lawn, also, and some homelike arrangement of vines, flowers and shrubs. The fences can be kept up, the buildings be painted, and the whole appearance of the place be

that of the home of a man who owns his farm and expects to live there in contentment, and with business foresight and energy is improving his home surroundings as fast as his means will permit.

Barn Buildings.

The most important features to consider in building a barn are light, ventilation, temperature and stall conveniences. The plans given here all contemplate some adequate system of ventilation. One method, very simple, is to make a continuous air shaft by boarding in tightly between two of the studding up to the plate, and from the plate up box in until the rafters are reached. From this point board in between two rafters, the same as for the studding. Another method is to construct an air-tight shaft from near the floor to the top of the barn—only be sure it is air-tight.

Following is the plan of a serviceable barn which can be built largely by the work of the farmer, and for very little money, especially if there are stones on the land for the foundation. Dimensions, 37x34, 12 feet at the eaves, 29½ to the peak. The loft is supported by sixteen 8x8 posts, if of sawn lumber. The roof has eight 6x6 purline posts. After the frame is built the stalls can be built from time to time. There are four horse stalls in front on the first floor, arranged two on each side of the double doors, with small doors opening out. The cross-passage is behind the stalls, and in front of the mangers, as all stock faces in. The three double cow stalls are on the right at the rear of the barn; while on the left at the rear is a shed with one side left entirely open into the yard. The granary and harness room are between this open shed and the passage behind the stalls. There is one window on the left and two on the right side. The space down the center should be 12x37 feet. The flooring of the second story can be added as desired, as ample room is left for accommodating from 20 to 25 tons of hay, and windows can be added in the gable where an opening 10x12 feet is left for pitching in hay.

The small doors for stalls are built in two sections. The upper section can thus be thrown open and take the place of a window. All the stock can be fed from the central floor, as the mangers all face inward. If the farm is to be largely a sheep or a cattle farm, the entire left side can be left open, making a shed 37x11 feet, with feed racks inside. This plan is simple and substantial and admits of additions and changes such as time may demand. Drainage, exposure, yard conveniences and the water supply being satisfactory, this barn offers many advantages to the farmer of small means, and few defects. Its chief defect is neither scarcity of light nor of ventilation, but the fact that all the stock face inward. This is convenient for feeding, but is wasteful of manure values as well as of time in removing the manure.

Such a barn would probably have only a dirt floor at first, but a dirt floor may be made quite satisfactory by setting a row of 2x6 at each edge of the gutter and nailing securely to strong stakes driven down so as to hold the joist up edgewise. Under the cows' hind feet place a two-inch plank twelve or fourteen inches wide and fill

Main Stock Barn, a model of construction, State Experimental Farm, St. Anthony Park, Minn.

up in front of it with earth stamped solid, spiking the plank to the 2x6 at edge of gutter.

Bed heavily with straw or hay; placing the fine short straw back under the cows' hind feet. The cows that are kept on a grain farm ought surely to have plenty of bedding if some lunatic does not set fire to all the straw piles. A burning straw pile is not a beacon of first class, progressive farming, to me at least, though it may be to some others.

I do not advocate dirt floors for cattle; remember I only say that until you can afford a cement floor, with gutters (the cement overlaid with planking), a dirt floor can be made and kept very clean by the above method and the use of plenty of straw.

Stone Barns.

A stone barn can be built on about the same plan as a house. There are several good ways of building a stone or cement barn. A very fine site for a barn is upon a rise of land facing the south or east. Such a barn, however, should not usurp the place where the home is to be built. Nor should it be built so that the house will get either drainage or odors from the barn. In such a barn, which will belong to the so-called basement type, the back and rear ends of the sides will be below ground four or five feet. The front will face the light, enabling the stock to face toward the outside, which gives them better light and ventilation. The windows should be large and from six to eight feet apart. They may swing in from the top, covering the open spaces below by triangles of wood when necessary. This gives ventilation without draft.

The front of the building should be sheathed with well seasoned lumber, both inside and out, the outside being good matched siding. The stock department will be below with two sets of doors for winter use where the stock go in and out. The floors for the stalls should be of cement covered with planks and the stable wide enough to drive a team and wagon behind the stock. Use bedding enough to take up all liquid manure. This must be removed every day.

Another method of building stone barns is to build on level ground, making the sides of stone and the gable ends of lumber. The stone sides should be studded inside of the wall, clear up to the plate, with 2x4's, leaving an air chamber four inches in width. Board the studding up to the plate on the inside. The windows are arranged the same as in the other barn.

Good Ventilation.

It is as necessary to ventilate stables, especially stables for dairy cows, as it is to ventilate the farm house. A system outlined by a Canadian official of the department of agriculture, while not promising perfect results, is worth heeding for its suggestions. Mr. A. P. Ketchen said, at a recent winter fair:

"The requirements of a good system of ventilation are: (1) A constant change of air in the stable. (2) The introduction and distribution of fresh air without drafts. (3) The liberation of the fresh

air at the window near the heads of the cattle in such a manner that they may breathe it before it is diluted with foul gases. (4) The removal of foul air without condensation and consequent dripping.

"To provide for the fresh air inlet, the floor of the feeding alley is elevated twelve inches above the level of the stalls. The inlet may consist of a ten inch tile, or a wooden box, about ten inches square, running under the floor the whole length of the feeding alley. This will admit enough fresh air for fifteen cattle; if more are to be supplied a conduit placed on each side of the feeding alley will be generally sufficient. The main inlet is tapped opposite each pair of cattle by the distributing pipes. These lead into the mangers and are placed close against the parting blocks, their open ends being prevented from plugging with dirt by a leather flap, or some other device. The foul air is carried off by means of ventilating shafts, leading from the ceiling of the stable out through the roof. Most farmers now run the purline post straight from the floor to the purline. Beside these posts is a very convenient place for the ventilating flues, they are out of the way, and they are not so readily chilled as when placed against the side of the barn. Excessive chilling of these foul air outlets not only reduces the convection current, but condenses moisture, causing it to drip.

These foul air outlets should be of good size, and should extend well up beyond the ridge of the barn. If they are not carried far enough above the roof, the current will often be in the wrong direction and instead of acting as outlets, the wind will sometimes force a strong draft of cold air down onto the backs of the cattle; just as a chimney that is too short will sometimes cause a stove to smoke.

It will be seen by this method, the fresh air is admitted, as in the furnace, below the heating area; it is distributed evenly and without drafts; it is liberated at the heads of the cattle, giving them a chance to use it before it has been diluted with the poisonous gases of the stable; as it is heated by inhalation, and by the heat radiating from the bodies of the animals, convection currents are sent up towards the ceiling, and out through the foul air shafts. This system is automatic in its action, the more stock in the stable, the stronger the convection current, and the more fresh air introduced."

Near Monticello, Minnesota, a unique barn with many practical advantages has been built. The work was done chiefly by the farmer and his sons. The frame is all made of tamarack poles blazed and straightened on one side. The barn is 34x100, has sixteen-foot posts and a basement eight feet high. It is built on a four-foot slope and the upper side is graded high enough to permit driving into the barn. There is a driveway lengthwise through the middle of the basement. The cattle face toward the walls, with feeding alleys between the mangers and the walls.

The grain bins are above, with spouts leading to the alleys below. The manure is thrown into a wagon or sled and hauled direct to the field.

During the first of the winter when the barn is filled with hay and fodder, the bedding can be hauled into the basement and scat-

tered where wanted, but later it is stored overhead and thrown through chutes into the driveway.

Lime should be freely used in all stock barns, for whitewashing etc. All the stalls should be gone over about twice a year and also the lime should be used freely and often on the stable floors. It makes a fine cleanser and keeps the barnyards in a healthy condition, acting as a disinfectant.

Sheep Barns.

All sheep barns should be lighted with large windows on the southeast and west, so as to let in plenty of sun. Feed racks are necessary in all stock barns for feeding in bad weather. All the doors should fit well and close firmly. In a recent issue of a Minnesota farm journal I found the following description of a practical sheep barn which is so good that I have copied it here:

"This sheep barn I have used for twelve years, and it is good for fifteen or twenty more. We have no sills and no rafters. Every eight feet there is a stringer 2x8 running the length of roof on each side spiked to top of manger and roof support. We set fence posts for side walls about one foot in ground, four feet apart. On top of posts we spike double plate of 2x4, for the manger and roof supports we use 4x4, every eight feet collar joist 2x6. Roof is boarded up and down with wide boards batted with six-inch fencing sided with sidelap.

"This makes the interior of barn in one room 26x80 with no posts in the way of stock. Sheep are fed entirely in yard and allowed to go in barn at will.

"I have a flock of Shropshires, about 400. Did not lose one last winter.

"We have double doors on track and rollers. We drive through with wagon to clean out.

"Total cost of lumber was $125 when lumber was cheap. Would cost nearly $250 now.

"You will notice that it would make a fine machine shed. I am sure if the farmers of Minnesota could realize they could build such a barn, it would be a great inducement for them to engage in sheep raising."

Machine Shed.

What this stockman says about a storage place for machinery reminds me how often protection for farm machinery is lacking around farm buildings. If you have ever tried to use rusty tools—say a rusty plow—you would say that unhoused farm tools are true signs of a "no count" farmer. There may have been enough money to buy machinery in the first place, but will there be any to replace the tools made worthless by such shiftless farming?

If the expense of a wooden shed cannot be afforded, a shed made from straw piles is easily and cheaply constructed. One that will house all the farm machinery of a moderate-sized farm can be made by setting a few posts firmly in the ground, and on the top of these spiking strong plates. Place some poles on top of the plates

and on these lay a few boards or planks. Stack your loads of grain near the shed and the straw can then be readily piled on the shed roof and spread around on three sides. Here you can house all your machinery as soon as harvest is over.

If timber is not handy for this shed frame, posts and woven wire will make a roof frame. Have this frame ready before the threshing machine comes, and then thresh a covering of straw ten or twelve feet deep upon the roof, letting it run over on three sides, and leaving the opening toward the best sheltered end. Such a shed can be used for a stock shelter, and for many other things. By this method instead of destroying the straw pile by burning, you are making use of it to the best advantage.

Corn Crib and Ice House.

In building corn-cribs the double crib, with a covered driveway between the sections, will give a cheap and most serviceable building, because the driveway furnishes shelter for wagons, whether full of corn or grain, or empty. Set the cribs north and south so that they will get plenty of sunshine and wind. The cribs ought each to be about seven feet wide at base, slanting outward on the weather side about a foot. Ten feet must be left for driveways. A quarter inch mesh wire netting tacked over the floor and sides will keep mice away from the corn. Eight feet is a good height for poles.

"Make the floors strong and smooth, using good sills and joist. The studding and rafters should be of 2x4 pine or hemlock placed two feet apart. The side walls are best when covered with a good quality of dressed 1x4 fencing, with a space of one and one-half or two inches between each board for the free circulation of air through the mass of corn. The walls of the crib may be covered more cheaply, and at the same time secure better ventilation, by using a storage netting made of No. 14 or 16 wire with 2x2 or 2x4 meshes. Staple the wire firmly to the outside of the studding which will make a very safe, durable, and, at the same time, cheap and neat looking corn crib. The gables may be boarded with matched drop siding and the roof covered with the best cedar shingles.

"Poles or planks should be spiked on the inside of the studding to keep the corn cribs in an upright position. They are top-heavy when empty and often become badly out of shape or easily wrecked in heavy wind storms. The early husked or damp and wet corn may be greatly improved in quality if the crib is provided with a supply of strong poles, cut the proper length and ends sharpened to it between the outside doors and extend across the crib. These will support the corn at intervals as it settles, and thus form openings underneath the poles that make ideal ventilation through the mass of green corn."

If there is a place near by where ice can be secured it would be very practical to build an ice house. It is possible to build one for $75.00. A six by ten foot house, built on a three foot foundation of rough stones or boulders, and with a drain pipe, can be made partly of old lumber. For outside walls use one-inch boards, seam stripped,

and for the inner one laths closely laid together. The space between should be eight inches, packed closely with sawdust and shavings. Any of the cheaper roofing materials will make a good roof. Sanded tarpaper is sufficient. Build on a bank which slopes to the north if possible. The door can be arranged to fit in like a safe door.

Sometimes an excavation is made in the side of a hill, and this is lined with posts set at frequent intervals upon which boards are nailed. Trenches for drains are made and the cakes of ice laid about ten inches apart; this space being filled with sawdust and crushed ice. When filled, about a foot of sawdust is piled on top and a one-sided slanting roof added. By co-operation among farmers such ice houses can be easily filled after January. A wood preservative or hot coal tar should be used for the wood. Have the house well ventilated.

Another method of making an ice house is by excavating a small rise of ground near the house. A space about eight feet deep and twelve feet square is dug in the side of this rise and lined either with hay, or rough boards, with an air space between the boards and the earth walls. This will hold a store of ice sufficient for a season's use. The hay lining is the cheaper, but the board one is the best in the end. You can roof lightly or permanently as desired. But there should be earth on the top of the roof, and the entrance, dug through the side of the elevation, should have some sort of a door.

Briefly, the important points in the construction of a cheap ice storage house are these: "It contains two rooms, one above the other. The upper is used for ice and the lower for fruit. Building the house against a side hill makes it easier to fill the ice room, and also increases the efficiency of the fruit room. The walls against the soil are preferably stone or brick; the other walls may be of wood, or all may be of wood. The wooden walls should contain one or more dead-air spaces, such as would be made by sheathing a 2 x 6-inch joist on both sides. These spaces may be filled with sawdust, hay, straw, leaves, excelsior or other material, but generally it is preferred to leave them empty. Below the ice floor is a sheet of galvanized iron or tin to catch the drip, and a pipe conducts it outside the building. The floor joist is not boarded next the wall, and the cold air settles down from the ice into the room below through the opening. The excess of moisture in the storage room is taken up with quicklime. Ventilation is secured at the top and from windows on the sides. Such a house, while of crude construction, is cheap and serviceable, but practicable only when ice is easily obtained."

If you use steel roofing or corrugated iron for roofing on any of the farm buildings, do not leave it unpainted or it will rust out in a season. Put on a good coat of roof paint at the first and then be sure to paint at least once in two years. As a roofing of general satisfaction and utility I know of nothing that gives more permanent satisfaction for the amount expended, than cedar shingles. If the farmer can afford to have them treated with oil they will last practically a life-time.

HOW TO BUILD A SILO.

From "Garden and Farm Almanac", Doubleday, Page & Co.

The earlier silos used in France and Germany were simply long trenches dug in the ground. Uncut green feed was stored in them usually and covered with a layer of straw and soil. The first silo in America, built on the modern plan, is supposed to have been constructed in Mayland in 1876. During the period from 1880 to 1890 there was much controversy on the question of whether or not a silo was really a paying investment for the farmer, and it was not until about 1890 that they were considered practical by the majority of people. Since that time large numbers have been built.

Why Build a Silo.

The silo enables us to preserve a greater quantity of the food materials of the original fodder, for the feeding of farm animals than is possible by any other system of preservation now known. The necessary loss of nutrients incurred in the siloing process need not exceed 10 per cent., and by beginning to feed from the silo soon after it has been filled, the loss will be reduced to a minimum which may not be far from 5 per cent. In hay-making or field-curing of coarse fodders, there is an unavoidable loss of leaves and other tender parts, and in curing fodder corn there will be a fermentative loss of nearly 10 per cent under the best of conditions, or about as much as is lost in the silo. The loss of dry matter will approach 25 per cent in ordinary farm practice and will even exceed this figure unless special precautions are taken in the handling of the fodder.

Essentials of a Silo.

The proper construction of the silo is of the greatest importance. If the sides are not made air-tight, too much air is admitted and the silage will spoil. If the walls are not perfectly rigid the pressure of the silage will cause them to spring out, thus allowing air to enter between the silage and the wall, and again the result is decayed silage.

As silage contains about 80 per cent water it is a very heavy feed to handle and as the feeding of silage is an everyday job during the whole winter and spring, and twice a day at that, the silo should be as handy to the manger as possible, and a cart should be provided in which to convey the silage. If the silo is inside the barn, the door to the silage chute should be kept closed to prevent the silage odors entering the barn at milking time, thus avoiding the possibility of their being absorbed by the milk.

The first silos in this country were usually built inside the barn, and consequently the square form was commonly used in order to utilize the space more completely. The square silo has not proved satisfactory, however, as it is practically impossible to build this form so that the side walls will not spring out and allow the air to pass down between the silage and the wall which invariably results in

the rotting of the silage. It has been thoroughly proven that the only correct form for a silo is round, because with this shape the walls can easily be constructed perfectly rigid.

The essentials of a silo are an air-tight structure having perfectly rigid walls. These essentials can best be obtained in the round wood silo plastered with cement. It has been definitely proven that the round silo is the only correct form. The wall can best be made strong and rigid by springing the lumber around horizontally as the enormous pressure can be resisted better and more economically with the lineal strength of lumber than in any other way. The best method of making air-tight this rigid wooden silo is to lath and plaster it with good sand and Portland cement. A silo of this construction, which is 20 feet in diameter and 34½ feet deep, having a capacity of 228 tons, was built at the University of Illinois in the summer of 1903. The first silos of this kind built in the state, so far as known by the writer, were three erected by Mr. H. B. Gurler, of De Kalb in 1897. (This is the style of construction frequently referred to as the Gurler silo.) These three silos have been filled every year and have given most excellent satisfaction. It seems probable that silos of this construction will not only preserve the silage perfectly but will prove to be lasting as well as economical for most sections of the state. As few silos of this type have yet been built in Illinois, a detailed description of the one at the University is given.

The excavation and foundation were made by cutting a circle 20 feet 10 inches in diameter and 4 feet deep, and laying up a four-inch brick wall against the clay. This wall was slushed in full on the back side with mortar so that every brick had a full bearing against the clay to resist the great outward pressure of the silage. Where the clay is solid a two-inch brick wall is quite sufficient. Three feet from the bottom and within one foot of the top of the ground the wall was thickened to eight inches and carried up six inches above the grade line, the top of the wall being reinforced with heavy wire. Where the grass is not kept down around the silo, the brick wall should be higher to protect the wood from dampness.

When a silo is placed in the ground, unless there is a good natural drainage through the subsoil, tile must be laid to drain the bottom or difficulty is almost sure to be experienced with water in the pit.

The sill was made of 2 x 4's cut into two-foot lengths; these were thoroughly imbedded in mortar made of one part of Portland cement to two parts of sharp sand, and the entire foundation was plastered with a thin coat.

The studs which were 16-foot 2 x 4's, were set on the sill and toe-nailed to it. A large post sixteen feet long was set in the ground in the center of the excavation, and boards extending from this to the studs about six feet above the foundation, held the studs perpendicular to this height. A half-inch board was then bent around the outside of the studs at this height and the studs were tacked to it as fast as they were plumbed. These boards held the studs perpendicularly and in a circle to a height of six feet. The lining, which was

½ x 6 inches x 16 feet long, made by splitting common fencing with a saw, was put on the inside beginning at the bottom. The upper portions of the studs were then plumbed and held in place by pieces radiating from the post in the center and by boards sprung on the circumference of the silo. To insure uniform strength through the silo, care must be exercised to break joints when ceiling.

Staging was carried up on the inside as fast as the ceiling. When the top of the first studs was reached, the upper studs were spiked to the sides of the lower, allowing them to lap two feet, and another section was plumbed. The ceiling was continued on the inside to within six inches of the top, and the plate, which consisted of 2x4's cut into two-foot lengths, was then spiked on top of the studs.

On each side of the line of doorways were set 2 x 4's spiked together to make 4 x 4's. These were placed so that the edge of the 2x4's faced the doorways leaving the flat side for the doors to rest against in resisting the pressure from the silage. In this way there was no crack through the 4 x 4's where the plaster and doors join.

As the silo was partially cut in two on the side where the openings were left, it was necessary to reinforce it between the doors. The strongest, cheapest, and most satisfactory way to do this was to ceil that side of the silo with an extra thickness from the bottom to the top, using half-inch lumber the same as that with which the silo was lined. The doorways were of course, left in the middle of this extra ceiling and the spaces between the doors were thus covered with two thicknesses, with no broken joints on three studs so that all of the strain at the end of these boards should not come at one stud. These irregular ends were filled out with short pieces so that the edge of the extra thickness would come in a straight line. Since this inner ceiling left a jog of a half inch, the thick edge of common shingles was butted against the ends of the half-inch boards, thus running the extra thickness down to a feather-edge and making an apparently even surface on which to lath.

The silo was then lathed with common four-foot lath, breaking joints and nailing the lath solid to the half-inch ceiling without furring out. It is usually recommended in lathing silos that the edges of the lath be cut on a level so that when nailed to the wall a dovetailed joint is formed for the mortar, or that the lath be set out on furring strips so that the mortar may clinch behind the lath. Experience shows that this is entirely unnecessary.

The plaster was made of one part Portland cement to two parts of good sharp sand. Two coats of this mortar were used making the plaster a full half-inch thick over the lath. The second coat extended continuously from the bottom of the brick work to the top of the silo, uniting the foundation and the superstructure and giving an air-tight wall for the entire silo.

Four doors were made of two thicknesses of common flooring run in opposite directions with tar paper between. These doors are each 20 inches wide, 2½ feet high, and are four feet apart.

Authorities on silo construction have erroneously stated that for silos 20 feet in diameter and 30 feet deep, three thicknesses of half-

A good model for a sheep barn, State Experimental Farm, St. Anthony Park, Minn.

inch lumber are required to give sufficient strength. This silo is 30 feet in height above the foundation and has not shown the slightest sign of giving in any particular.

Theoretically the outside covering should be put on horizontally so that the strength of the material which forms the cover might add to the strength of the silo. There are, however, several practical difficulties in putting sheeting on in this manner. The lumber cannot be more than a half-inch thick and spring to a circle of twenty feet or less in diameter, and any siding as thin as this, which is carried in stock is practically clear lumber and necessarily high priced. Another difficulty is that the only half-inch stuff that can be purchased at the lumber yard, which will make a water-tight cover, is common house siding. This, in order to be sprung to a circle, must be rabbeted on the back side of the thick edge so as to fit over the thin edge of the board below and allow the siding to lie flat against the studs. Rabbeted siding cannot usually be obtained at a lumber yard and it is extra trouble and expense to have this work done at a mill. Another serious difficulty in putting the siding on horizontally is that at the end of each board there is a strong outward pull against the nail heads and as soon as the boards become slightly decayed at the ends they are likely to pull off over the nails.

Owing to these objections and to the fact that it was our aim to use, as nearly as possible, lumber that is carried in stock by all lumber yards, it was decided to put hoops on the outside and build them up of the same half-inch material as the inside sheeting. This was done by using three thicknesses and breaking joints, thus making a strong six-inch hoop 1½ inches thick. Seven of these were placed around the silo between the doors to make a continuous even surface on which to nail the sheeting. The silo was sheeted up and down with common 1x12 barn boards, 14 and 16 feet long, and the cracks were covered with common three-inch battens.

After the silo was completed a conical shingled roof was put on, a chute built over the doors through which the silage is thrown down, and the small space between the silo and the barn roofed over, connecting the two. The silo was then completed ready for painting.

The silo has been filled three times and the silage has kept perfectly from the bottom to the top, even next the wall and against the doors.

In order to preserve the silo in good condition it is absolutely necessary that the half-inch lumber with which the silo is ceiled be protected from dampness. To this end the plaster must be of good quality and kept perfectly water-tight by cementing up any cracks that may appear, so that the wood shall receive no moisture from the silage. The wall must also be ventilated, for by allowing a free circulation of air between the sheeting and the lining the lumber will be kept dry. In this silo a two-inch space was left at the top above the plaster and below the plate. In this way the air was allowed free access to enter from the bottom, between the outside covering and the inside lining, and pass into the silo through the openings at the

top. These spaces were covered with heavy wire netting of one-third inch mesh to keep out rats and mice.

The cost of this silo, which was 20 feet in diameter and 34½ feet deep, holding 228 tons, was $383 or $1.68 ton capacity.

The expense of a silo will vary in different localities according to the price of labor and material.

The number of tons of silage needed can be readily estimated from the size of the herd and the amount to be fed daily. Even where it is desired to feed as much silage as possible not more than 40 pounds per cow should be fed daily. Silage will usually be needed about 200 days. Each cow should have an allowance then of 200 times 40 pounds which is 8,000 pounds of silage, or four tons per cow for the year. A herd of ten cows will require a silo holding 40 tons; a herd of 30 cows, 120 tons; 50 cows 200 tons; and 100 cows 400 tons. Where young stock is raised an allowance should be made for them. From the amount of silage needed, the dimensions of a silo of the required capacity may be determined from the table, which gives the capacity in tons of silos of different diameters and depths. These estimates apply to silos filled with well-matured corn that has been allowed to settle forty-eight hours and then refilled. It is evident that to get this rated capacity, a silo which had been filled rapidly must be refilled after settling forty-eight hours.

In building a silo, the method of construction is more important than in the other farm buildings. From the very nature of things a silo is subjected to unusual conditions. The silage is packed in under pressure, consequently the side walls must be rigid. Then, too, in order to keep silage in good condition, it must be made sufficiently air-tight to prevent the silage from spoiling. While most farmers can construct an ordinary farm building that will answer all practical purposes, in building silos the service of men who are thoroughly familiar with the use of tools and methods of construction is necessary. A plan definitely worked out is necessary also, because the silo is primarily the one farm structure in which mistakes must not occur, and the plan one which cannot be developed as the building goes on.

Approximate Capacity in Tons of Cylindrical Silos of Different Diameters and Depths. Computed from King's Table.

(The diameter is shown at the top of the columns and depth at the left.)

	Inside Diameter in Feet.						
Depth, Ft.	10	12	14	16	18	20	22
20	26.2	37.7	51.2	67.	84.7	104.6	126.6
21	28.0	40.3	54.8	71.6	90.6	111.8	135.3
22	29.9	43.0	58.6	76.5	96.8	119.6	144.7
23	31.9	45.9	62.5	81.6	103.3	127.5	154.3
24	33.8	48.7	66.3	86.6	109.6	135.3	163.7
25	35.8	51.6	70.2	89.6	116.1	143.3	173.4
26	37.9	54.7	74.4	97.2	123.0	151.0	183.8

Depth, Ft.	10	12	14	16	18	20	22
27	40.1	57.7	78.6	102.6	129.8	160.3	194.0
28	42.2	60.8	82.7	108.1	136.8	168.9	204.3
29	44.4	63.9	87.0	113.7	143.9	177.6	214.8
30	46.6	67.2	91.4	119.4	151.1	186.6	225.8
31	48.8	70.3	95.7	124.9	158.2	195.2	236.3
32	51.1	73.6	100.2	130.9	165.7	204.6	247.5
33	53.4	77.0	104.8	137.8	173.2	214.1	258.7
34	55.8	80.3	109.3	142.8	180.8	223.6	270.0
35	58.2	83.7	114.0	148.9	188.3	232.2	281.5
36	60.6	86.9	118.3	154.7	196.3	242.0	292.1
37	63.1	90.4	123.1	160.8	204.3	251.9	303.9
38	65.5	94.0	127.9	167.0	212.4	261.9	315.9
39	67.9	97.3	132.8	173.5	220.6	272.0	328.1
40	70.3	101.1	137.8	180.0	228.9	280.2	340.4

Cost of Filling a Silo.

The cost of filling a silo has been carefully worked out at the Illinois Experiment Station from records kept on nineteen farms. It ranges from forty cents to seventy-six cents per ton, the average being fifty-six cents. The variation was due to distance of hauling and the degree of system by which the work was done.

How to Protect Buildings from Lightning.

From Garden and Farm Almanac—Doubleday, Page & Co.

The protection of farm buildings from lightning is a different matter from what it used to be considered. Luckily the changes that have come about in our knowledge are such that the expense of providing protection for a set of buildings is much less than it was under the old system.

The principal change is the substitution of iron for copper in the conductors. Since copper is so much better a conductor of electricity than iron, it was always supposed to be necessary to use heavy copper cable in lightning conductors. But experiments have proved that iron will serve the purpose just as well and is safer, owing to the fact that there is less danger of setting fire to the building in the momentary heat of the lightning discharge.

To equip a farm building with lightning rods, the following material should be provided. First, a quantity of No. 3 double galvanized iron wire. Enough of this should be on hand to provide a cable running the length of the roof of the building and at least two cables running from the ridge of the roof to the ground, one on each side of the building. Also enough to provide for the pieces of upright wire that should project into the air from the ridge of the roof, every six or eight yards. No. 3 wire is approximately one-quarter of an inch in diameter. Second, a supply of heavy galvanized iron staples. Third, connecting tees of the proper size to unite sections of one-quarter inch wire. Fourth, enough aluminum paint to coat the wire and the tees thoroughly.

If the flexible iron cable can be secured instead of the solid iron,

it will be found much easier to handle, since it can be shaped around chimneys or other bends more easily. Also it can be unwound a short distance back and thus made into good points for the sections that project into the air.

No attempt should be made to insulate the iron from the building. This is entirely unnecessary. To erect the conductor all that is needed is to run a section of the cable along the ridge of the roof, fastening it in place with staples. At each end and at one or two places along the roof, depending on the length, tees should be inserted in the cable to hold the uprights. If there is a cupola or chimney on the building, one of the uprights should be run along this and project beyond the top of it. If solid iron is used the top of each upright should be filed down to a point. If the flexible cable is used, the wire should be unwound a few inches back from the end. It is not necessary that the uprights should project far above the main cable. Two and a half feet is enough.

The lower ends of the cables that connect the ridge of the roof with the ground must be so placed as to reach moist earth in the shortest possible distance. The ground connection is best made by coiling the lower end of the vertical cable, giving it several turns and making a coil a foot or more in diameter, and then burying this coil deep enough in the ground to be in moist earth even in dry seasons.

The number of vertical conductors necessary will depend on the length of the building. For most buildings one on each side will be enough, but for large barns there should be a vertical conductor on each side every twenty-five or thirty feet.

Where the building is covered with tin or other material there is no need of running the cable along the ridge of the roof. All that is necessary is to provide vertical conductors carefully soldered to the middle of the roof and ending in moist earth as already described.

All joints should be made tight so that they will not break apart or otherwise come loose. If there is a metallic water pipe running into the building, connections should be made between it and the vertical conductors, provided the lower end of the water pipe runs into moist earth.

It is advisable to apply two coats of the aluminum paint, and to repaint the iron every two or three years in order to prevent rust.

The Farm Water System.

According to the prevailing idea the well of the farm house should never be dug in a ravine or low place, especially if this spot is a few feet lower than the barn or any place which may be a source of foul drainage. Authorities differ as to this, however, modern sanitation claiming that nearly all forms of bacterial or germ life exist in the upper twelve feet of the soil. If the subsoil is a sandy one the water that filters through the subsoil may usually be considered pure.

However, the safest way to build any well is to have it water-tight and dig it twelve feet deeper than is necessary to strike water. Fill in the bottom with twelve feet of sand, and this will make a filter for the water which runs down the outside of the walls to find its

passage up through the sand. If your well is dug in gravel it is necessary to dig a much larger hole at first than you need and also to use an octagonal crib with smaller ones inside as you descend in digging to prevent the gravel sliding in. In case the water supply is in the barn the basins should be thoroughly cleaned once every two or three weeks. Then dip out all the water you can and dry well. When installing a barn water system avoid all the crooks and turns possible and use at least a one-inch pipe. It is a good plan to have your own plumbing tools for repairs and construction work of this sort. This will save you time and money, for with the tools it is quite simple to do most of the repairing yourself. The necessary tools include two pipe wrenches, a cutter, a vise and a set of dies. The vise and wrenches are tools in such great demand for general use that they are so much farm capital.

System of Hog Farming.

A system of hog farming which has been successfully worked out by an Illinois farmer, calls for four equal fields of 20 acres, fenced hog-tight by a five-foot woven wire fence with a barbed wire above it. The fields meet at the center, and here there is a well, a small feed yard for use in winter, and a shed for storing feeding troughs, etc., in the summer. Fifteen brood sows are kept. These raise eight pigs to the litter, once a year. These four fields are so rotated that one is in clover. This field is divided by a temporary wire fence into two parts, one of 12 acres and one of 8 acres. The yearlings, 120 in number, are turned into the twelve acres in early spring to stay there until time for marketing, in August. The cows and pigs go into the eight acre section until August. When the large hogs are sold the temporary fence comes down and the mothers and pigs have the run of the whole plot. During summer whatever grain is fed is given them near the shelters. When the ground gets muddy a new place is selected. In summer hogs are better off with only a ground floor to the hog-house. Movable houses that can be lifted off the floors are practical. Floors are necessary in winter when all the feeding should be done indoors.

Fence Building.

Choose your posts carefully when building a fence. Red cedar makes the most durable post with the exception of cement. The high price of cedar posts makes them almost a prohibitive article in most localities. Cement posts can be made by the farmer or stockman if sand can be had in the locality. They can be used either for wire or board fences. However, if you have any timber in your neighborhood the wooden post will suggest itself at once as the most economical. The corners are the most important part of any fence. Use large posts, set in holes that are at least four feet deep and three feet square, and anchor well. A combination of barb wire and wire netting makes a very good fence. Use the thirty-inch netting, with two wires above and one at the ground to keep the pigs from rooting under. When set the posts should stand at least four and a half feet high, or even five feet if much stock is kept. A good way to

keep stock from using the gate post for rubbing against is to protect it by a barb wire stapled four feet from ground to gate.

Concrete Walks.

Permanent walks around the farm house and buildings are not such expensive improvements as many farmers think. Any man of ordinary common sense and attention to details can lay a concrete walk by following a few simple directions. He can lay his own concrete foundation if he will. The tools needed are a box or a platform of smooth boards for the mortar, hoes and shovels, a spirit level, a trowel such as is used by plasterers, a maul for making foundations firm and an edger for striking off smooth surfaces.

One part of cement to five parts of gravel is the formula for the foundation. Guide strips of 1x6 laths must be laid down by exact measurement to keep the walk to straight or regular lines. Mix the cement with the gravel while dry. Work it over and over many times and mix thoroughly before wetting. Then wet slowly while working and put it in place at a depth of about four inches, working fast so that the concrete will not set. As soon as it begins to set put on an inch of top layer made of two parts clean sand and one part cement. Rub this over and over with a trowel to get a smooth, hard finish, and keep it moist several days after it sets, using either wet sand and thick, or wet gunny sacks. For flooring for stables, dairies or other farm buildings, lay parallel guide strips of 2x6 straight scantlings about every three feet and lay the mixture in these belts to the same depth. As such floors should be laid with an eye to being washed, a fall of 1½ inch to every ten feet must be planned for.

A cheaper cement can be made of flashed coal tar and sand, but it is more difficult to handle. The results are akin to asphalt.

CHAPTER VII

Pasture and Meadow

STOCK should be allowed as large a run of good pasture as possible and every live farmer expects to give more or less of his land up to pasture. But land suitable for crops ought not to be used for pasture, and modern farming, with the increasing practice of the soiling system, is learning how to utilize the waste farm lands for pasture land.

If the soil of the intended pasture is poor it must be rid of weeds by mowing the annuals frequently during the summer and rooting out the perennials. Plow, fertilize heavily, reseed often and occasionally apply lime. Use a pasture mixture of a good many different kinds of grasses, as some grasses need plenty of time to reach their best estate and others come along quickly into service.

Breaking on new prairie land varies according to the soil and climate. The general method calls for a light breaking of the soil as early as frost is out of the ground. As soon as the sod has rotted, disc and backset. This leaves good land in the best shape for wheat the next year. If the soil is very light and the land scrubby it is best to break deeper—three or four inches—and seed to a light crop of oats or flax. Scrub and brush must be removed before plowing, and be sure that shear and coulter are in good shape all the time. For backsetting, a sulky plow should be used with plenty of horsepower. On Canadian farm lands, cattle are often used for this work, either alone or with horses. Remove all stones, if possible, while breaking, so that you can leave a clear field behind for the backsetting. Yet this is not generally done, farmers waiting for slack days. This necessitates going over the same ground again.

Old highland pasture should be re-seeded with white clover and alsike clover, mixed with Kentucky blue grass and medium red clover, every six to seven years. Sow the seed in the winter, as follows: Two quarts of white clover, two quarts of alsike or Swedish clover, four quarts of Kentucky blue grass and two quarts of red clover, all mixed together. Sow about eight to ten quarts to the acre before the barn yard manure or fertilizer is put upon the land. Spread from the load, fifteen to twenty-five loads of stable or barnyard manure per acre are sufficient, and this can be put on in the winter after the seed has been sown. The old pasture should be prepared by being harrowed about two inches deep late in the fall, before sowing the seed. The fresh dirt, together with the top dressing of manure, will keep the roots from drying out. Pasture thus heavily top dressed in winter with barnyard manure will also produce feed in a long drought, early spring grass, and late fall pasture. The high lands are the best for dairying, and such lands, where the above plan

is followed, will produce from two to three times the amount of pasture.

In covering pastures with manure do so in the fall or early winter, or else very early in the spring. This conserves soil moisture and encourages the growth of grass. When such land is plowed for crops the gradual decay of manure and the residue from the sod will bring average soils into better condition and the crop will be increased more than by the direct use of manure upon grain land. The action of the grass roots upon the soil changes its physical composition, making it darker in color, retaining more moisture and more responsive to sunlight. If the pasture has not produced much feed, sow a mixture to the acre of three pounds of alsike clover, two pounds of medium red and six pounds of timothy. Then top dress for the fall as directed.

If your rainfall is not abundant, or if any special season is dry, don't pasture the hay fields too closely in the fall. The meadows go into the winter uncovered, and clover plants are likely to suffer. The next spring the grass will be slower in growth and your yield of hay much less. Some amount of pasturing can be done, but it must be so managed as not to allow close cropping over the whole field. On the whole, it is best not to pasture the first fall after seeding to clover or any grass.

Clover and Cow Peas.

Blue grass and white clover on permanent pastures are apt to make the soil sod bound, especially on hilly or stony land. To prevent this, mulch with the bottoms from the straw stack, or with manure early in the spring. The stock will not feed then, but the field will be ready by August or September, and the output of the pasture will be doubled.

In the northeastern part of Minnesota clover grows with great luxuriance, and as the line is followed down along the eastern border of the state clover remains a standard paying crop. In other sections of the state, where it has been introduced with some difficulty, repeated crops prove that clover thrives on itself. Success in clover growing seems to depend upon persistence in growing stands year after year.

Seed can be cut from alsike clover for two or three successive years, occasionally for a longer period. In some parts of the far west red clover lives many years, producing seed, if allowed to, every year. The small white clover also lives for a long period, producing seed every year. In the central and eastern states clover lasts longer, however, if it does not bear seed, as has been proven over and over again.

Where clover cannot be grown to the profit of the land, cowpeas make a tolerably good substitute. But though cowpeas gather nitrogen, their roots are not so long as the clover roots, and therefore they cannot bring up fertilizing material from the subsoil as the clover does. A deeply penetrating root like that of the mammoth clover enriches the subsoil and aids it in retaining moisture.

For cutting cowpeas the attachment of a pea harvester to the cutting bar of a mower greatly helps the process. This little tool lifts up any forage lying on the ground so that the mower knife can work from the underside and cut clean. The cost is small and the help great, not only in harvesting more peas, but making the labor of bunching the peas less.

Stock In Pasture.

All good farmers agree that stock should never be turned out to pasture when there is no grass in the spring. A herd of cattle will do great damage in a few days by tramping the pastures and packing the ground hard, thus destroying the grass roots; then, as soon as the spring and June rains are over, there is no pasture for the dairy the rest of the season. The best pastures are those that are never plowed—if they are rightly cared for. The pasture should not be harrowed if the grass roots are thin. Sow very late in the fall or in winter up to the first of April. A good mixture to use is from four to six pounds of blue grass, red-top and white clover to the acre, and top-dress with all kinds of farm manure. I have top-dressed pastures with coarse barn-yard manure, and find that 10 acres so treated will produce far more than twenty left without this fertility added.

Another reason why stock should not be turned out to pasture until there is a good growth of grass is that with scanty pasturage the stock are kept on their feet all day picking a few spears of grass. The best time for stock to feed is before the dew is off in the morning. If you have not plenty of good spring pasturage, keep on with the winter rations for eight or ten days longer and remember that upland pasture is the best of all. Red-top, blue grass and white clover is the ideal combination for dairy pasturing, but medium red clover, timothy and June grass make also a fair pasture.

Meadows.

As to meadows, the best place for a permanent meadow is either on land too rocky for general tilling, on hillsides, or in lowlands that are likely to be swampy at times. The best time for preparing meadow land is after the early hay harvest is over, when a light spread of manure is good, and this followed by another during the early winter. If the grass sod is worn out, scratch the surface very early in the spring and re-seed. If you use only one kind of grass, August and September are the best months for sowing. One kind of grass for the permanent meadow is advised by many farmers. Clover, if added, is best sown in the spring.

Some lands are more suitable for permanent meadow than a permanent pasture. Drained and well cured marshy and peaty soil often produces red-top, timothy and other kinds of hay in abundance. Such meadow lands should have some grass seed sown on the poorest parts, for instance, alsike clover sown early in March before the frost is out of the ground, and then manured later. These lands usually hold a good deal of water. If pastured, the trampings of the animals cut the sod and destroy the grass roots. Yet, by proper treat-

ment, many such peaty soils can be so cared for as to become valuable hay lands. Follow the plan of feeding no stock on them, sow seed on the barest spots early in spring and dress heavily with manure in the winter or fall. This will help to bring out the new grass roots. Don't cut these too closely, as a few inches of stubble will hold the snow and protect the grass. If you can get a second crop late in the summer, mow it and let it lay on the meadow and rot.

An Eastern Meadow.

One hay grower in the East, who had the reputation of growing more hay to the acre than any man in the East—Mr. George Clark, of Connecticut, says that he prepared his soil so thoroughly that it was worked at least fifty times over before any seed was sown, working very deeply at first, and afterward more lightly until every particle was broken. Then the seed was sown lengthwise and crosswise twice, using fourteen quarts of timothy and the same of red-top to the acre. By thus going over and over the soil the plant food was made available at once and the soil so pulverized that seed would get lodgment immediately. This sowing brought Mr. Clark seven and three-fourths tons of hay to the acre, with two cuttings. If expensive clover seed is sown upon such a prepared soil none will be wasted in sowing.

Timothy and clover may be sown on winter grain as soon as it comes off in the spring. After sowing put on a little drag and if the grain is drilled in, drag lengthwise of the drill enough to loosen the dirt and cover the seed. Use six to eight pounds of medium red clover seed per acre and six or seven pounds of timothy. If alsike clover is added the proportions might be changed to four pounds of clover, three pounds of alsike and seven or eight pounds of timothy. If medium red clover alone is used, sow from eight to twelve quarts per acre, and the same of the mammoth clover.

Alsike clover should always be sown with other grass seed and clover for hay or pasture. Sow the same number of pounds of seed in the spring seeding and drag the seed in. The best way to sow clover and timothy seed is always to sow it with a drill.

Nurse Crops of Grain.

When grass seed is sown with grain, especially spring grain, the quantity of grain should be from a third to one-half less where clover and other grasses are used. A thick seeding of grain is injurious to the young grass. If the weather is dry and hot in harvest time, oftentimes the grass is lost after the grain is cut. A thin sowing of grain is the best for a good stand of clover and for all kinds of grasses. In mild climates clover and other grasses can be sown in the latter part of August and up to September 20th with a nurse crop if the ground is plowed and put in first-class shape. Make a compact seed bed by fall harrowing this early fall plowing. No stock should be put on this and with this firm seed bed there will be no trouble from the freezing and loosening of the soil.

Another good method is to seed on clean corn stubble without plowing. A first-class seed bed may be made on this by disking or shovel plowing, after which clover can be sown with a nurse crop. If the intention is to do this, the greatest possible amount of stubble and aftergrowth should be left as winter protection.

Remember that one acre of clover plowed under represents, in the soil fertility gained thus, ten tons of stable manure. The best time to sow crimson clover, which is to be turned under the following spring, is from late June to September.

For sowing June clover about four quarts of clover seed to one of alsike clover and two of timothy makes a good mixture. If oats or barley are used with the clover, do not use too much. Barley or wheat are better than oats as they do not shade the ground so much, nor take up so much water.

Seeding to Clover With Spring Grains, Such As Oats, Wheat, Barley, Etc.

In the latter part of the June of 1906, the writer seeded a piece of sandy land for Hon. J. M. Hackney, of Hamline, Minn. The land had not been tilled for years and the vegetation on it consisted of weeds and native grass. These were all plowed under and the whole thoroughly harrowed. Seed was then mixed as follows: One bushel of oats, eight quarts of medium clover and six quarts of timothy seed. The mistake is usually made of putting in too much grain seed, thereby choking out or weakening the cover crops. In the above case, the summer following the hay crop was of the best. I presume that 95% of the losses are due to the use of too much seed grain. Often it comes up so densely that the young grasses are shaded and their vitality weakened so that when the grain is harvested and the grasses are exposed to the sun and dry winds they will perish.

In seeding for hay or pasture a mixture of the varieties of clover and timothy is very good. The clovers improve the texture and fertility of the soil and also make excellent hay besides being a fine pasture for honey bees.

Cutting Clover.

There are various opinions about cutting clover, but I prefer to cut when clover is in full bloom. It should be cut in the forenoon and raked up in the winrows and bunched or cocked the same afternoon. The natural moisture of clover or hay will not spoil it, but the water from rains and heavy dews does. All sorts of grasses should be cut and cured the same way for bright, sweet hay. If hay is fit to buy you can tell by tasting it. If not sweet don't buy it.

The best hay for all kinds of stock is medium red clover. After an experience of thirty years in curing clover I find that clover hay should not be cured in the swath in the sun. The leaves are all lost and the more it is handled the poorer the hay is. The farmer who raises clover and corn successfully is the successful farmer. He will have plenty of the best fodder for his stock and his soil getting richer every year. I have often heard it said that a ration of clover hay with

four quarts of oats would keep a horse in far better condition than eight quarts of oats and timothy hay.

Hay should be stored in the barn thoroughly wilted, but with no water in it. A small quantity of water in a large hay mow will depreciate the value of the whole mow for both feeding and market. The natural hay moisture never spoils it, however.

Clover should not be left out in the field, for one rain on it depreciates the feeding quality greatly. If it looks like rain, put it in the barn, even if quite damp. Sprinkle a little salt on it, and the hay will come out all right. If you have no salt handy, mix in good, fresh straw with it. More clover hay is spoiled by drying in the field than in any other way, for the leaves which are thus lost are the best part.

The second cutting is good feed for hogs, mixed with roots and a little corn. But as clover hay contains a large per cent of protein, horses should not be heavily fed with it, especially when the hay is first ready for use. All stock eat it greedily and it must be used with caution.

Cutting Timothy.

Timothy should be cut as soon as the blow is off, and this should not dry in the swath. In good weather, when raked into winrows, it will dry and cure very fast. Stack as soon as possible and avoid a rain. One ton of early cut hay is worth two cut later for dairy purposes. Timothy is best cut before it blooms for cow fodder. In general, no hay should be left to lie in the sun. Oats cut green make good feed for the dairy cows. Cut just after the oats berry is past the milk form and just before the straw begins to turn yellow, and stack under cover as soon as possible. The hay caps now in use made of ducking are invaluable for rain or wind protection. With a few hundred of these caps a big crop of hay can be handled without any risk of damage from dew or rains.

It must be remembered that the aroma from grass makes a part of its feeding value. When new mown hay lies and bleaches in the strong sunlight, the loss of color is accompanied by a loss of this aroma. Gathering it into cocks or bundles checks the loss of color and smell, and keeps the natural moisture in the hay. The hay "sweats" in the cock or barn, and this is just what it should do.

Hay Heating.

If you suspect that your hay is heating, which is generally made known by a certain peculiar smell, put a thermometer in any handy tube and push it down into the middle of the stack. If the record on the thermometer is at all doubtful pull the hay apart and let in the air. As this condition is supposed to come from too much moisture, the salt sprinkling method mentioned before, one pound of salt to one hundred pounds of hay, should be used on every load of hay that has to be hurried to cover before it is quite dry. Scatter on with care that too much is not given. Straw laid in layers between green hay is also recommended. Stock do not object to this at all, but eat the straw apparently with as much relish as if it were hay.

Manure Spreaders.

In spreading manure over meadows the use of a manure spreader does away with the need of any after attention. Summer manuring not only doubles the crop of grass, but it makes a second cutting of hay for the fall. Whether you manure broadcast from the wagon or by the spreader, do it as soon as the first hay harvest is off the fields. Spread the well rotted manure in moderate thickness, seeing to it that the poorest patches of stubble get attention first, if there is not enough fertilizer to cover the whole field. If you spread from the wagon go over afterwards with the harrow or brush in order to cover more evenly. The field will produce thicker sod, weeds will be crowded out, and the value of your meadow doubled in yield and durability.

In general, it may be said that the farmer will do well if instead of summer fallowing, he will raise more cultivated crops for fodder, and keep more live stock to increase the fertility. Forty acres seeded to brome grass for pasture, and maintained for four years, then plowed and cultivated to grain will yield two bushels where one grew before. Seed another forty in another part of the land and repeat the process. You will soon get returns from your live stock that will not mean a corresponding loss of soil fertility, as is the case where only grain growing is carried on. Many farmers who are short on pasture and long on stock will get rapid results by sowing together oats, medium red clover and alsike, 1½ bushels oats, 6 quarts clover and 5 pounds alsike per acre. For loose, dry soils, this method is excellent.

The following is a group of four mixtures for humid climates having severe winters and is taken from a Canadian farm paper:

(A)

Medium Red Clover	3 lbs.
Kentucky Blue Grass 1	8 lbs.
Orchard Grass	8 lbs.
Smooth Brome Grass	10 lbs.

(B)

Medium Red Clover	2 lbs.
White Clover	2 lbs.
Meadow Fescue	5 lbs.
Smooth Brome Grass	8 lbs.

(C) For High, Rather Thin Soils.

Mammoth Red Clover	3 lbs.
Kentucky Blue Grass	8 lbs.
Orchard Grass	8 lbs.
Smooth Brome Grass	10 lbs.

(D) For Low, Wet Lands.

Alsike Clover	4 lbs.
Red Top	6 lbs.
Timothy	4 lbs.

All the components of Mixture (A) start very early in the spring, and the clover and brome grass will remain green and continue to grow during quite dry weather.

The following article on alfalfa was originally prepared for the "Garden and Farm Almanac," but by permission of the publishers of the Almanac, Doubleday, Page & Co., it is included here.

How to Raise Alfalfa.

One of the most frequent questions asked by correspondents of experiment stations throughout the country is how to raise alfalfa.

The failures or partial failures that many farmers have experienced in their first attempts with this crop have deterred many from undertaking its cultivation. This is unfortunate, for alfalfa is one of the most valuable crops that has ever been introduced on American farms.

As a matter of fact, the cultivation of alfalfa is not especially difficult. It does require a certain amount of care in the preparation of a seedbed in getting the crop started, etc., but these are no more than are required for any other crop. The difference lies in the fact that alfalfa is new to most farms and farmers, and many others have not become acquainted with its peculiarities.

As to its value in most systems of farming there is no longer the slightest doubt. Its roots penetrate to great depths in the soil, thus serving the triple purpose of drawing on the deeper soil moisture, of gathering plant food from considerable depths and leaving parts of the same at the surface, and, finally, of opening up the soil to the depth of several feet. The tops constitute one of the most valuable forage crops that we know, and, finally, the whole plant belongs to the group that gathers a large part of its nitrogen from the air, storing it up in nodules on the roots.

The Best Kinds of Soil.

The popular impression that alfalfa can be grown only on rare and peculiarly suited types of soil is wrong. It will thrive on any good, well-drained soil. In an investigation conducted by the Indiana Experiment Station, it was found that out of 83 plantings on different farms in clay soils, 68 were successful; out of 188 plantings in loam, 167 were successful, and out of 77 plantings in sandy soil, 69 were successful. In other words, the kind of soil is not one of the most important factors in getting a good catch of alfalfa.

It is important, however, that the soil shall be well drained. Where ground water stands within three or four feet of the surface the crop will not thrive. Such soils may often be tile drained, and after the lapse of sufficient time will become well fitted for alfalfa, but until this time it is idle to try to induce the crop to grow in such ground.

A fact that is not always sufficiently well recognized is the need of this plant for large amounts of proper plant food. Any crop that makes the tremendous root system and growth of top characteristic of alfalfa must have abundant food with which to carry on its process of manufacture. Therefore a soil from which the plant food has been largely removed by wasteful farming will not prove suitable for alfalfa. There needs to be a plentiful supply of humus in the ground.

Getting the Soil Ready.

The first thing to do is to determine with certainty that the field which it is proposed to plant to alfalfa is not acid or sour. Most farmers will readily recognize a sour condition of the soil from the character of the weed growth. It may further be tested with blue litmus paper, which will be turned more or less red on contact with moist soils that are acid in character.

If the soil is acid and the field is otherwise suitable as regards drainage and soil fertility, the chances are that an application of lime will correct the acidity and place the field in a receptive condition. Lime may be applied in the form of ground limestone or in other forms. Usually ground limestone is best. The application of lime should be made a considerable time prior to the proposed planting of the alfalfa, so that the cultivation before planting will thoroughly mix the lime with the soil.

The preparation of the seedbed should be thorough, as indeed it should be for most other crops. It is just as important that the surface of the soil be fine and mellow as it is that the soil be well drained. A light top-dressing of stable manure is one of the best means of maintaining a fine mellow condition of surface soil.

The Weed Question.

It is essential that the ground be reasonably free from weed seeds. The best way to secure this condition is to keep a hoed crop in the field for one or two seasons before seeding it down to alfalfa. It should be cultivated frequently during the spring and early summer until the time for seeding is at hand. These cultivations will destroy most of the weed seeds that germinate and will leave the surface soil reasonably free of weeds or viable weed seed.

Selection of the Seed.

Alfalfa seed is small and all too frequently is adulterated. These adulterations can readily be detected by a small hand lens, such as can be bought in optical stores for fifty cents to a dollar. Samples of the seed should be looked over carefully and a rough determination made of the amount of dirt and weed seeds present. If these are considerable, the seed should be returned and a different supply bought.

Planting the Seed.

Alfalfa may be sown broadcast or may be drilled in. The latter is the better way, since it invariably gives more uniform results. The amount of seed to be used will run approximately twenty pounds to the acre. Successful planting may be made at any time during the late spring and early summer. This will depend on the amount of other farm work, the rainfall, and the condition of the field that is to be planted. The difficulty with planting in late summer is the possible occurrence of droughts which will prevent securing a good stand. The difficulty with planting too early is the possible smothering out of the alfalfa by weeds.

When to Cut Alfalfa.

The young plants should not be mowed so long as they do not start to bloom. Many farmers have followed the practice of clipping the young plants and some have seemed to get good results, but the safer plan is to allow them to grow until they give signs of blooming. As cold weather comes on, the tops of alfalfa will die down and these will protect the roots and crowns over winter.

The Question of Inoculation.

If alfalfa is to be grown in a field where it has never been before, it is wise to inoculate the soil. This is done because there must be certain species of bacteria in the ground in order that the alfalfa may properly gather nitrogen from the air and store it in the nodules on the roots. These bacteria may be present already in the soil, but it is far safer to introduce them artificially.

This can readily be done in most cases by securing soil from a field in which alfalfa has been growing and scattering this over the new field. At least two hundred pounds of soil per acre should be used. This soil should be kept from too long exposure to bright sunlight and should be harrowed in just as soon as it is scattered over the new field. Otherwise many of the bacteria will be killed by the action of the sun.

CHAPTER VIII

The Vegetable Garden

TO know how to cook well and economically is of even more importance to the farmer's wife and daughters than to the city woman. For the farmer and his family there are no handy restaurants or department store cafe, where if the home cooking is bad, the family can get a taste of something better. The farm table is too apt to fall into a round of fat meats and the coarser root vegetables. In fact, on most farm tables the potato is the only vegetable.

It takes time and labor to have a good vegetable garden. Time and labor are costly assets in the farm life. Yet, from that very fact, it is the duty of the women of the household to use every means to develop and increase the working power of the farmer's labor day. A good day's work is best done on a well-fed stomach. That means a diet where fresh fruits and vegetables in the summer time are as much a staple as flour and meat. For this reason a good vegetable garden is a prime need on a farm, whether for market or home use.

The beginner in kitchen gardening is apt to be rather conservative as to space, which is wise. A little garden well tilled is much better than a big one, half cultivated and harvested. Besides, the ordinary family cannot make good use of very large crops of the more tender vegetables.

Begin Small.

In order to benefit by the rules set down here begin on a small scale, therefore. A plot of 100 by 150 feet will give, with the right management, and a succession of crops, all the vegetables needed for the farmer's table. An acre will not only supply the vegetables and fruits for the farmer's table, but will leave a surplus for the market.

However, if you want to get the best results from your farming, let the women of the family manage as large a vegetable garden as you can spare, and see that they get the needed help in the heavy work at the right time, even if it does sometimes appear inconvenient. Choose a good sunny plot for your garden and don't stint it too much as to size. The farmer who starts a vegetable garden has the advantage of tools, manures and mulching at hand. His only expense therefore will be for his seeds. Select a sandy loam, if possible, plow in the fall, cultivate often and drag sufficiently to keep out the weeds until you are ready for spring planting. A garden free of weeds to start with is so much easier to tend. Get seeds from a reliable seedsman and as soon as you can work the ground plant onions, parsnips, a few radishes and beets, carrots, lettuce and some early peas. The tenderer vegetables may escape the early frosts. If they do, you

will be that much better off as to early vegetables. If they do get killed, work the ground over well and replant.

In two weeks plant a few more radishes, lettuce, beets and peas for summer use. If you want sweet corn, plant that quite early and make three plantings 8 or 10 days apart. Cucumbers planted after June 1st are not so liable to attacks from the striped bug. Plant winter beets about the same time.

House Planting in March.

In general plant as much as possible with the idea of rotation, so that your vegetables will furnish your table for the whole summer. Your tomatoes, cabbage and cauliflower sow in the house in March or in hot-beds. As soon as the second leaves show up well, transplant to a cold frame four inches apart each way. See that they have plenty of moisture and keep covered on very cool nights.

Wet thoroughly before transplanting to the open ground and leave the plants with dirt on them four inches by four inches and three inches deep. Put in holes dug large enough so that they will receive this lump of dirt without breaking and plant a little deeper than in the cold frame. Plant toward evening and in the morning clip off with shears some of the outside leaves of the cabbage and cauliflower, but do not touch the tomatoes. Leave a few plants in the cold frame to fill out with, if needed. If you follow these directions carefully, have prepared your seed bed thoroughly in the fall and have bought your seeds from a good seed house, you will have very few failures in your garden. Even if the season be a dry one, faithful cultivation will make up for a great many of Nature's shortcomings.

The great advantage of starting the more tender vegetables indoors is that better results are secured, as a rule. The plants are stockier, you can save the strongest plants and thin out the weaklings, and you can often benefit these strong plants by two transplantings before setting out in the open. In this case the second transplanting should be when they have grown three or four leaves. The best plants to start indoors are tomatoes, peppers, egg-plant, the last two of which are very tender, and need to be kept warm day and night; all varieties of cabbage take a long time to grow, as does celery, and need an early start.

Vegetables should not be crowded, and no second crop planting should be between the rows until the first crop is matured and harvested. The soil should be refertilized and cultivated before the second planting; if crowded they become weak and feeble, therefore give plenty of room for an abundant growth.

Manures or Fertilizers.

Any reliable dealer will give you a good general "garden fertilizer," and if you want to get quick results, these are most valuable. But there is nothing to equal the staying power of stable manures. As a restorer of worn-out soils this has no equal in applied fertilizers. Manures combined with clover crops, turned in deeply for a couple

of years, must be used in order to get the best results from commercial fertilizers.

The latter on poor or worn-out soils, are like whips to a tired horse. You may get a spurt of activity, but the horse is that much worse off later on. Feed up a starved soil first before you begin the practice of hurrying it along. Every dollar of the commercial fertilizer will pay its full value then. Manure not only gives plant food, but organic matter, "humus," as well as needed bacteria. It acts mechanically upon soil and holds moisture. Fertilizers are just food. In using garden fertilizers do not stint them. For some soils 1,000 lbs. per acre will be ample, but others will need a ton. Put about half on by sowing broadcast after plowing and before harrowing, and the rest when the drill is used. Don't let it come in contact with the seeds or roots at that period. This rule is for large market gardens. Smaller ones will suggest hand methods for distribution of the fertilizer.

The fall is the best time to apply an added mulch of manure to the hardy perennials. Asparagus and rhubarb especially require it, because it gives the needed stir-up to nature's forces in the spring, when early garden vegetables need to be helped along. In April, nitrate of soda applied before a rain will hurry up the new growth. In June and July some more of any quick acting commercial fertilizer may be given. The nitrate of soda applied at intervals of about three weeks, may be apportioned in quantities of about one ounce to three gallons of water if the season is a dry one. But if wet scatter the nitrate on the ground—an ounce to a square yard and rake well into the surface.

In winters that are open, with freezes and thaws, the value of a mulch of manure in the garden is very evident. It not only protects the plants from being lifted out of their winter beds by the breaking up of the earth in the sudden changes of temperature, but it is adding food to the soil.

The Cold Frame.

The question of climate must always be considered in open ground planting or in early seed growing indoors. Fine seed plants need generally continued warmth, and in a Minnesota climate, for instance, warm nights are not likely until the last of May or the first week of June.

In northern climates, some plants always need forwarding, by means of the seed bed, or cold frame, in order to get early results. A seed bed must be made for permanence, as it can be used all through the summer. A southern exposure in a dry plot is very necessary, and a thoroughly made frame of one-inch planks, from four and a half to six feet wide and any length desired should be constructed. This should be about 18 inches high at the rear, but only about half as high in front. The corner stakes should be from two ft. to 2 ft. 3 in. in length. Set in the ground with rear planks about six or seven inches above ground, and front ones only two or three inches above. It needs about two or three inches of slope for drainage and sunlight.

Get the best quality of soil, prepare it thoroughly, so that it will be free from lumps and well pulverized. The following plants may be sown three inches apart in hot-bed: Cabbage, Cauliflower, Endive, Celery, Kale, Parsley, Kohlrabi, Head Lettuce, Egg-plant, Leek, Peppers.

A table for the time it takes common vegetables to show above ground follows, also the probable time of edible use.

Radishes—From three to six days after planting. One month to 45 days.

Lettuce—From six to eight days. One month to 3 months.

Endive—From five to ten days. About 45 days.

Peas—Six to ten days. 40, 50 to 80 days.

Beans—Five to ten days. 50 days.

Celery—Twelve days to twenty. 170 days before using.

Cabbage—One week to ten days. About 100 days.

Cauliflower—One week. About 125 days.

Corn—Seven to eight days. From 55 to 90 days.

Onions—One week to ten days. From 100 to 160 days.

Turnips—Four to eight days. From 60 to 70 days.

Parsnips—Ten to twenty days. About 140 days.

For each hundred miles north or south of your own latitude allow about six days' difference in time of planting. In the latitude of New York City such quick growing vegetables as radishes, lettuce, corn salad, endive, and spinach could be grown from September plantings, but not in Minnesota.

Hot Beds.

A hotbed for early seed growing is excellent. Have a good frame which can be covered by a couple of storm windows. Set it up in a warm, protected place, where the rays of the sun will fall directly on the glass, not obliquely, during most of the day. A high board fence, the south side of any building near the house, or a shelter belt of evergreens will make a good protection.

Potatoes.

Potatoes make one of the most profitable crops that can be raised. In the northwest especially, the potato crop is coming to be one of great importance. Because of the excellent quality of the potatoes grown in this locality they have a wide reputation.

A clover or alfalfa sod is the best kind of ground on which to grow potatoes. A grass sod comes next. A rich corn stubble is good. In more southern localities ground that has grown cowpeas or soy beans previously should produce good crops. A heavy dressing of manure—20 loads to each acre—put on evenly by a manure spreader, is not too much for some soils if you want big yields. But there are many localities where good crops can be grown without manure. Plow the land in the spring or fall reasonably deep so as to bury all sod—making the seed bed deep enough so that seed may be planted four inches deep on the turned sod.

Winter rye, grown as a catch crop between two crops of potatoes

and then plowed under is specially good as a fertilizer and preventive of scab. Canada field peas are good. You can grow both in a single season if necessary. Or, try a crop of corn raised on the grass sod soil and plowed under after well manuring. Potatoes thrive well after such land treatment and are fine in size, brighter colored and free from scab.

Another method that has been tried successfully for building up potato land is to dress good sod land with acid phosphate and muriate of potash before plowing for corn. Rye follows this to be plowed under in the spring. Dress with same fertilizers again and sow to cow peas, which can be used for forage. Harrow and sow rye in the second fall. In the next year prepare for the potato crop after plowing under the rye. For very thin soil this is sure to produce results.

Potatoes require a large amount of potash for their best development, but they also require a goodly supply of nitrogen and phosphoric acid. Many growers attempt to grow potatoes with wood ashes, potash salts and other fertilizers rich in principally potash, but this is a poor policy unless it is known that the land is well supplied with the other essential forms of fertility.

If straw has previously been spread 4 to 6 inches deep on the ground and plowed under in the fall your year's straw will return you from $4 to $6 per ton. Horse stable manure with plenty of straw in it is good. Too solid manure is apt to make scabby potatoes. If the intention is to apply stable manure to the potato land the stock should be heavily bedded with straw or leaves.

How to Plant.

In planting potatoes, if you have not a planter, mark one way with a light marker and the other with a light plow. Then drop the seed potatoes, take the drag and cover by crossing the furrows. If once does not cover them deep enough, lap the drag. Cultivate as soon as the potatoes come in sight, throwing deep, about three inches, at first, but later, when the potatoes are a few inches high, cultivate lightly. The cultivator will do the hilling.

For a small plot of ground plant the potatoes for drills from 2½ ft. to 3 ft. apart, the last being best for most varieties. Drop the seed about 15 in. apart in the row. The number of eyes left to each cut seed depends on whether early or late tubers are being used. Usually more eyes are left in the late seed than in the early.

Then harrow twice, if possible, before the seed comes up. The harrow should run across the rows the first time to level the land. On very loose soils, the weeder must then be used. A one-horse weeder is the best to manage. Cultivate the soil towards the plants. The sooner the dirt is around them the better.

If the ground is very dry put the weeder to work in two or three days after planting. No seed potatoes should be left for sun and wind to dry up, but constant cultivation should be practiced. Set the cultivator teeth so that the dirt will be thrown toward the plants the first time of using it and continue this through the season. If you use this method the center of the potato hill becomes the lowest and

holds all local showers. At the last working hill to from 4 to 6 in. above the level.

I have cultivated, in the light, sandy soil of Anoka Co., Minn., as an experiment, on the Wittig farm, two potato plots, one by the deep cultivation and hilling method, and the other by shallow and level culture. The first method yielded one-half bushel of potatoes from six hills. The second required twenty-two hills in order to fill a ten-quart pail. The quality of the potatoes was also greatly increased in value by the hilling on light soils.

On heavy soils, however, do not hill. Level culture is better. On such soils hilling after the plants are ten inches high causes the growth of additional tuber-bearing stems to develop, which makes the plants produce two distinct crops, both of which will be of inferior size potatoes.

Seed Potatoes Should Be Whole.

Seed potatoes, for a good crop, should be the middle size of the last year's crop. If cut, cut once in two the long way of the potato. Plant soon after cutting. Potatoes yield much better when the seed is planted immediately after cutting. I have proved this by actual experiments on the same soil with the same cultivation. Potatoes planted at once after cutting not only came up several days before the others but made a stronger growth and yielded a larger crop of perfect potatoes.

Potatoes intended for seed should not be left in a dark place until late in the spring, to sprout and grow together. Spread out the seed potatoes thinly in a dry and light room. Too much of the growth principle goes to waste by letting potatoes sprout.

Very small potatoes are not good as seed. You may get a fair crop from them, but you are far more likely to have a poor one, especially where you plant small seed year after year. The size of a hen's egg is the best size for seed. And I may add that this size, planted whole, especially in a dry spring, will be pretty sure to give you excellent results. Whole potatoes used for seed and put in dry ground do not shrink. Only about one-fourth of whole seed ever grows to maturity.

A very good plan, and one that is practiced here very little, if at all, is this one of planting whole potatoes the size of a hen's egg, or larger, instead of slicing up big ones. The writer traveled over a section of northern Minnesota, where it was said to be excellent for producing potatoes. Of 20 or 30 fields visited a very large per cent had failed to produce—in some about one-tenth of the hills had failed. This condition was undoubtedly due, in part, if not wholly, to the fact that sliced potatoes or cut seed had been used. These were placed undoubtedly in the dry, sandy soil, then after planting, no rain came to wet the ground, and the cut pieces dried up, so that the vitality was lost.

To guard against this condition whole potatoes should be planted. Potatoes the size of a hen's egg are best. This system is used generally in New York by the most successful growers. Medium pota-

toes of the size of large hen's eggs can thus be planted in dry soil and not lose their vitality. A second reason for planting whole potatoes has to do with the eyes. About one-third the eyes on a potato do not mature—the stronger eyes take the substance from the weaker ones—thus, when a whole potato is put in, one is sure that some of the eyes will mature. Then it stands to reason that there will be more sprouts and these will be hardier, and it has been proved by actual experience that about 3 times as many potatoes are secured in this manner. These are more uniform in size and demand the best market price. In the case of sliced seed the potatoes resulting are few and overgrown, often being hollow.

A field of clover plowed under makes an excellent seed bed, or 40 loads of coarse barnyard manure to the acre, plowed under, will be equivalent.

Potato Culture.

A good way to treat potatoes to keep down weeds is to put on straw, after planting, so that weeds cannot come through. Fine straw that cattle have pounded to pieces laid on so that a shovel plow can still run between the hills and turn straw and some dirt on the hills, is said to be a good method.

Turnips make good fertilizer for potato land, even if only used for harvesting. Plowed under they are splendid in returns, and can be grown after the crop of early potatoes is dug.

No matter how strong your early potato plants look, don't fail to spray them with the Bordeaux mixture about three times every months from the time growth is well established until the first or middle of September, according to latitude. This is the only safe way to ensure against the potato blight.

A power potato digger is a great help to the commercial potato grower. By digging for his neighbors he can soon pay for its cost.

An excellent authority on potato growing is T. B. Torrey's "A B C of Potato Culture." Bulletin No. 118 of the Minnesota College of Agriculture gives good advice and a great many comparative tables as to potato experiments and studies in 1909.

Potato Diseases.

For blight in potatoes Bordeaux mixture is the specific as a preventive. But it must be used in time, for if blight once gets a hold, all the spraying you may give the plants will do no good. The potato plants should be sprayed with the Bordeaux when they are but six inches high and be sprayed thereafter at intervals of every ten days until from five to seven applications have been given. When the potato bugs put in their appearance the Paris green can be added to the Bordeaux mixture as though the latter was mere water, and a combination spray will be had that will both prevent the diseases and kill the beetles. One ounce of the Paris green will be sufficient to add to every six to eight gallons of the Bordeaux.

The expense of spraying is hardly worth mentioning when compared to saving a crop worth one to two hundred dollars per acre.

A good way of treating potatoes to prevent them from sprouting and therefore shriveling is given by an Eastern potato grower. Before the potatoes are stored soak them for one hour in a solution of one pint sulphuric acid to twenty-five gallons of water. Mix the solution thoroughly before immersing the tubers. After removing them from the bath allow them to become thoroughly dried and then store them away in barrels or large boxes. Tubers thus treated retain all of their edible qualities but are useless for planting purposes. Aside from killing the sprouting portions of the potatoes the solution kills the decay germs, and potatoes thus treated are not liable to rot in storage.

One pint of commercial formalin to thirty gallons of water is a good solution in which to soak seed potatoes as a preventive of scab. A corrosive sublimate mixture is sometimes used, but great care must be exercised with this. Soak with the formalin for two hours before planting. Use a barrel or tub for container. Draw the water through a bung hole and use it again. You can use two barrels to advantage by filling one while the other is soaking. If potatoes already have scab, cut them after they are treated, but spread in the sun before cutting.

Marketing.

Dig potatoes in dry weather, if possible. If you can manage to harvest them before the fall rains set in, they will come out of the ground very clean and be of more market value.

Any farmer who does not thoroughly acquaint himself with the conditions of his own market and the best way of disposing of his garden crops deserves not to have the good steady customers that can be found in all market towns, whether for wholesale or retail trade. Well sorted potatoes, all small, rough and bruised potatoes being discarded for market purposes, will greatly add to the potato profit. Care in the sorting and handling of the potato crop will bring returns three or four times as large per acre as can be had from other western crops. Yet they ought to bring much more than they do. Another point: when you exhibit at fairs be sure to name your products wherever varieties are called for. Then when potatoes are likely to be low at wholesale, look out for family trade, rather than to sell in the open market.

Rhubarb.

Rhubarb plants should be set from two to four feet apart and in rows 6 feet apart. The best method of propagation is to divide old roots. The second year, if set in good rich soil, the stalks can be used somewhat. The third year the crop will be full. By not coming to blossom, rhubarb can be had all summer, but it does better if given a period of rest. Barrels without heads can be set over plants in order to obtain long, tender stalks. If glass is put on top of these the rhubarb will be improved in flavor.

Where rhubarb is to be forced for commercial use in the spring the clumps should be lifted late in the fall, set close together on the ground to freeze, and covered with enough litter of straw to keep

them dry. When frozen solid, remove to the cellar and pack in sand until February.

The Victoria is a good variety of rhubarb and a very large, early and a vigorous grower.

Radishes.

Radishes need a light soil and plenty of water. Given the right quality of seed, and frequent watering, radishes will be ready for the table in four or five weeks after sowing. They are best in rows a foot apart and not so closely sown that they will need thinning. In frames or greenhouses, four inches is thought enough space between rows. The scarlet turnip radish grows very rapidly. If new seed is put in when radishes are pulled a succession of radishes can easily be had on a very small plot. In such a system, though, cultivate well and keep the ground active. Put seed in about one-half inch deep. Keep the earth well fertilized.

Lettuce.

Lettuce growing, for any one who lives near city markets, is not much favored in these days of excellent and cheap hothouse lettuce, but for the farmer's wife, the summer lettuce bed should be started in the latter part of March, in the house. Transplant to a partially shaded situation as soon as the ground is warm enough. Sub-irrigation for lettuce is now more and more used by market gardeners, but many people claim that more lettuce is produced by surface watering.

If the lettuce earth-louse attacks your plants try bisulphide of carbon poured in holes six inches deep and one foot apart between the rows of lettuce, one tablespoonful to each hole. Fill the holes immediately with soil. This will kill the insects, but you had better dig up the lettuce bed, as it will be of no special value afterwards and try a crop of something else—almost anything but celery.

The Big Boston lettuce is a good variety for fall use, and may be sown about the last of July. If the cool weather reddens the leaves cover the plants with a thin sprinkling of straw or salt during cold nights or days.

When sowing lettuce, do not sow the seed too thickly, nor too deep. One-half inch apart and about the same depth is a good rule. Cultivate as soon as the rows can be seen above ground, with either the small garden tool sold for that purpose or with an ordinary large tined kitchen fork. Cultivate lightly at first, merely scatching the surface at a little distance from the plants. Every three or four days is often enough for cultivation, but as the plants develop, get closer to the stem and deeper into the soil. Water freely when the soil is dry.

In order to prevent the bitter taste of lettuce late in the season, keep the bed, as I have said, well shaded. Some lettuce growers erect burlap frames as covers for small beds of lettuce for family use. This method keeps the leaves tender and crisp, and almost as well bleached as the inside of head lettuce, while often superior in flavor.

Endive.

Endive is a salad plant which is growing in favor more and more. The curly endive is probably the most tender variety. Sown in April, it will be ready for the table about June 1st. A succession of sowings every two weeks until June or July, will give salad for fall use. The cultivation of endive is about as for lettuce. Sow in drills or in rows and thin to about a foot apart. The plants thinned out can be used. Pick the leaves off the plants left when four inches in length. If cut off, other leaves will grow. If it is desired to blanch it, draw the leaves together and tie about a month before it will be wanted for the table.

Onions.

Multiplier onions never grow large and their place is better filled by the perennial onions. These are often ready for table use as soon as the frost is out of the ground. Plant in the fall. The old plants left in the ground produce a new crop in the spring. They can stand very thick in the row.

Chives, which have a small leaf like grass, to be eaten, are also perennial. If you get good seed you will not fail to grow chives. For a flavoring herb in soups they are popular, and also in summer salads. The stock is increased by dividing the bulbs.

If you wish to try okra or gumbo, get the dwarf varieties for the north. They are early, and the pods, which are excellent for stewing when young, mature earlier. As a rule, however, okra does better in the southern states or the middle central. It is easily grown in the right temperatures.

Whenever it is desired to keep the young onion sets producing beyond June be sure to use the seed producers first, or else pinch out the seed stalks. Onion sets should be planted three to four inches apart in rows one foot apart and three inches deep. The best way is to make a furrow of this depth and cover each set with the rake, firming well over each. Onions do not keep well through the winter. The Red Globe are the best keepers.

Spinach.

One of the great advantages of a spinach bed is the succession of crops that can be had. By the use of liquid manure a quick growth is secured, and eight or ten plantings can be made between April and September. As the chief value of spinach is in its youth and tenderness, a large plot is not necessary for the home garden.

After the early spinach of May and June six plantings can still be made for fall and winter use. Sow twice in July, August and September. As the season advances, seed should be sown much thinner. In fall the plants spread and are ranker in growth. Late spinach can be left in the garden until after the early frosts, which always improves its flavor. Where spinach is capable of being wintered, hoeing must be kept up weekly until hard frost prevent. The New Zealand varieties are excellent as standards.

The prickly spinach has a great reputation for flavor and early

growth; and it is the early "greens" which seem to be the most desired. Spinach, on the other hand, can be sown as late as October in some latitudes for spring use. The winter thick leaved is good. Mulch heavily with straw, leaves or salt hay.

Early spinach should be cut just as soon as it is large enough to be properly prepared for the table. The plants go to seed before fully grown in June.

Asparagus.

If economy is to be observed very closely in the home garden, it is better to start the asparagus bed from seed. This means that you do not expect to get results for about four years, as an asparagus bed needs about a year of thorough preparation, and then about three years of growth after sowing seed before any cuttings of value can be had. If you decide upon the seeding process fertilize the plot for the bed early in the preceding spring, spading in at least six inches of well rotted manure. During the summer rake often and repeat the process of spading over at least once and then rake again until the surface is smooth and the earth thoroughly cultivated for at least a foot or more in depth. Seed with clover and leave until the next year when another fertilizing with rotted manure, about half as much as before, spread over and spaded in will give you the rich mellow soil needed for asparagus.

A very large plot of ground is not required for family use. One thirty feet by ten feet will be ample, but the deep cultivation beforehand is a prime need, as no further cultivation of any depth can be given. A dressing of common salt once a year is said to give a better flavor to the stalks, as asparagus is a salt water plant.

Sow the seed in drills. The plant can be lifted the next year and transplanted into furrows about two feet apart and eighteen inches between plants. Some authorities require four feet apart in furrows, but this is for commercial planting, where fine stalks are desired. If one wants to get asparagus sooner, buy plants from two to three years old. They are usually very cheap. Do not transplant in the fall. The spring is the safe time, unless you want to risk winter killing. If the asparagus plot is wanted for early spring use, it can be treated late in the summer or some cover crop put on in the fall beside clover. After the bed is once started keep up its fertility by manuring heavily after the cuttings have been made, and keeping this on as a mulch. Commercial fertilizers, which will act quickly, are needed in the spring. The first planting of asparagus plants should come up in about ten days in any normal season. If you don't get good results from plants the first season replant freshly next spring, but keep up your fertilizing process. Care taken at the outset will give you an asparagus bed which will last a generation, with proper cultivation from year to year. Plant seedlings in rows four feet apart, and have three feet between the plants. Set from six to eight inches deep. Plow and harrow the plot each year about the middle of June, when cutting usually stops. In the fall cover deep with well rotted manure to the depth of several inches.

If you plan to raise asparagus for market purposes, don't count on less than five acres. Prepare the land in the season before, if you propose to start with the plants. Spread a heavy four-inch dressing of rotted manure over the plot in the late spring. Plow and harrow. Seed to rye. The next spring put on a second layer of manure. Plow dressing and cover crop under together, and then furrow as directed before. For commercial purposes three feet each way is the nearest that roots should be set for fine "grass," and four feet is better.

Professor S. B. Green, late horticulturist of the Minnesota School of Agriculture, advised applying manure in June just after cutting ceases and working it well into the ground. It is a common practice to mulch asparagus with manure in the fall and work this in in the spring. But many gardeners in the west claim that this protection is not needed, as the depth of soil over the crowns is sufficient protection and the manure on the surface holds the frost and retards the starting into growth. The bulletin of the United States Bureau of Agriculture also recommends using manure heavily immediately after the cutting season, say in June, as that is the season when the roots are storing up food for next season's growth and forming new buds. It prefers, however, leaving the manure on the ground as a mulch to keep down weeds and to keep the ground moist.

In New Jersey and some other eastern states a different method of raising is sometimes used. For small families John I. Sipp recommends an area nine by twenty-seven feet. In this case plant five rows lengthwise the bed, placing the first row fourteen inches from either side of the margins and the rows twenty inches apart. The plants in the row should be placed eighteen inches apart, giving about twenty plants to the row or 100 plants to the bed.

The season before setting out the plants, if the area can be spared from other garden vegetables, spade into the soil about the last of June a six-inch layer of rotted manure, working over the upper strata of earth during the spading operation to the depth of fifteen inches. During the next six weeks rake over the surface of the bed at weekly intervals, and about the middle of August give the bed another good spading and rake the surface down smooth. Then seed the area to crimson clover. Nothing more need be done to the bed until early next spring, when a four-inch layer of rotted manure should be spread over the clover and the bed spaded. The plants should then be set. From that time on the fertility of the bed can be maintained by summer manuring, fall mulching with manure and spring applications of quick acting fertilizers.

Should the area be planted to other crops at that time, wait until after they have been gathered, then proceed as directed above. If the crops are not all off until late September or early October, substitute rye as a cover crop for the crimson clover.

Asparagus can be forced in the cellar for winter, but as the best clumps must be used and are worthless afterward, practical commercial gardeners do not advise it. In the field, the work is usually done by a trench between two rows, at least two feet deep, and filled with green manure. Over rows and trench a cold frame is built and

this is banked with green manure. When this process is an early one, the frame must be covered on cold nights.

In cutting off asparagus tops, which should be done in late September, cut a few inches above the surface, and burn the tops at a distance. This is a great help in disposing of insect trouble or disease. If two year plants are bought for small plots, they can be cut a little the next spring. But just as much care must be taken as for commercial purposes in getting the bed ready, and the plants must be set at least six inches deep. Cover about three inches at first and the shallow and frequent cultivation that must be given will soon fill up the trench.

The best varieties of asparagus are Conover's Colossal, Columbia, Mammoth White, Palmetto, and Burr's Mammoth. This last is a standard market variety and very large, tender and early.

Tomatoes.

The great commercial value of a tomato crop lies in the growing of early varieties, which will possess the qualities of color and flavor of the late types. Selection of seeds counts greatly here. Choose any good, early variety, and by careful cultivation and seed selection a few years will be pretty sure to evolve a fruit evenly ripened, with smooth skin, firm flesh, and early maturity.

No better tomato can be recommended for the home garden than the Earlianna. In any ordinary season it begins to ripen by the last week of July. Get good plants, do not have the soil too rich or too poor, transplant carefully and cultivate thoroughly and if you do not have prolific bearing it will be one of those mistakes of nature for which no man can account. Sometimes these plants run all to vine. Cut back all the leading stems then, and this will often help bearing. Very dry weather will always reduce the early tomato yield, and will cause the underneath leaves to dry up badly.

Start the plants under glass in March, says a Minnesota gardener. "When plants are two inches high, transplant into flats, thumb pots or plant boxes, and later transplant again, giving more room. Never crowd the plants, but keep them short and stocky. Plants already in bloom or with fruit set, if in wooden plant boxes or in pots, may be transplanted to open ground without disturbing their roots, and will continue to bloom and fruit without check. Set these sorts six feet apart each way in warm, mellow soil of fair fertility as soon as danger from belated frosts is past. For main crop, the plants can be started somewhat later, in hotbed or cold frame, once transplanted to keep them stocky, and then set in open ground, in fairly good warm soil, five feet apart each way. A very ornamental show can be made in the home garden by training tomato plants to stakes, poles or trellis. Applications of superphosphate, or of some good complete (vegetable) fertilizer often have a very happy effect on tomatoes in hastening maturity and increasing the yield."

Select an open, unshaded spot, where the soil is a retentive, sandy loam. Wood ashes are an excellent fertilizer for tomatoes as they are rich in potash. Be sure, however, that the other essentials of soil

fertility are not lacking. Train your tomatoes by the pole method if the gardener has only limited ground. The crop is extended over both ends of the season and both quantity and quality are improved by training the vines to climb. The foliage not being so thick they ripen earlier, snails do not eat the fruit, and it can be gathered much easier. Cultivation by the hoe can be frequent, also.

The poles are driven on the north side and are from six to eight feet long. A crowbar is recommended to help out the labor of placing these. They are driven in about 18 inches deep and 3 feet apart and well pressed in by earth. All side shoots are kept pruned off after the plants are a foot high, and the top runners only are retained. These are tied, one on each side, to the pole by soft strips of cloth or binding twine. Tie at regular spaces as the plant grows; about every six inches, or once a week, if the yield seems likely to be heavy. In the fall pull up the dead plants at the roots and leave them on the poles to dry.

If many tomatoes are unripened when frost comes, the vines may be pulled and hung in the cellar. Or, if you have a good, ariy barn loft, spread the larger ones on the floor, and they will ripen gradually in a moderate temperature. Green tomatoes put under the hotbed sashes will often ripen. Piled along the south side of the house and covered with old sacking at night they will keep until Christmas in some latitudes.

No matter what the method of growing tomatoes, do not cut off the leaves on the main stems very freely until the fruit is well formed. Cutting off the leaves too early is a loss of material for plant food and therefore to the production of fruit. Keep the soil about the roots moist, but not too wet. Don't water the foliage.

When plants are in bloom, in order to insure thorough pollenizing, either strike the poles sharply each day about noon, or brush the flowers lightly with a soft brush. Where tomatoes are grown in the hill, the fruit will ripen quicker and more evenly if the vines are pulled open to the sunlight. If you follow the stem method, don't try it on the dwarf species of tomato. Almost any of the other popular varieties will do well, if you are sure to get good plants—whether from your own transplanting, or from a nursery.

If tomato seed from one's own patch is to be saved select the first fruits to ripen for this purpose. The ground cherry or husk tomato may be grown by the same methods as the ordinary tomato.

Bordeaux mixture will tend to keep the blight and rot away from the tomatoes if the plants are sprayed every ten days until the fruit begins to color. If the tomato worm or the potato bug is troublesome add a little Paris green to the Bordeaux. Hand picking is also good.

The variety of tomato to be raised is a matter of some importance. Livingston's Perfection and Dwarf Champion are especial favorites. The owner of a large truck farm says that he always raises Mammoth Ponderosa, no matter what variety he may grow for the market, as they have fewer seeds and are more meaty. More pounds of fruit per plant will be obtained than from any other kind.

Raise some plants of Golden Sunrise, a large yellow tomato, as the two colors look very attractive when sliced together on the same plate.

At Crystal Springs, Mississippi, there has been for a long time, a system of tomato culture, of which I give the following detailed account. The tomatoes are set three or three and one-half feet apart. When the first sucker (branch) is two inches long, it is pinched out, as are all suckers that appear afterward. The pole method is then followed, requiring from three to four tyings until the tomato reaches about four feet from the ground. Then the bud is pinched out.

This gives a plant with a dozen or more very big leaves, and five or six clusters of great, perfect fruit. By this way it is claimed that there is no danger of the tomatoes rotting or mildewing. They ripen earlier than by any other method of stalking and can endure dry weather better, as well as be cultivated easier. The vine can be trained to two stalks, if a bushier plant is wanted.

The writer has proved by experience that the following method is successful:

Having decided on the location of the bed, set up planks one foot wide and excavate inside the enclosure to 2½-foot depth. Then fill this in with two feet, when trod down close, of fresh horse stable manure. Wet this very thoroughly and place about 6 inches of rich soil over it.

It is now ready for planting and the plants should be placed 4 feet apart each way. These can be set three weeks earlier than those planted in open ground.

The bed should then be wet twice a week after being planted. If the evening air gets down to freezing point have 2x4's or any convenient pieces of wood ready so that canvas can be stretched across the bed and protect the plants. No glass need be used at all, as the heat evolved from the fresh manure will make the plants grow when seeds placed in ordinary cold ground lie dormant.

The writer has also found that the faster a tomato is grown the more meaty it is and the less seeds it has. Also the tomato is more uniform in size.

These ripen some 4 weeks ahead of those planted by the old method and all are ripened before early frost.

Beets.

Garden beets thrive in loam. A rich, sandy loam, planted at the rate of about five pounds to the acre, in drills twelve to eighteen inches apart, and the seed covered to a depth of about one inch, will generally give good returns. Thin the rows to four or five inches apart when beets are well up. You can plant every four or five weeks during the spring, if a succession of young beets, or beet tops for greens, is wanted. Sugar beets will do very well for winter use. If only a few rows of beets are needed two ounces of beet seed will be plenty, sowing about 100 feet to row. Do not sow until all danger of frost is over. If they are to be cultivated by horse, leave 30 inches for cultivation, and sow in a double drill 6 inches between.

For very early table beets, to be pulled when small and very tender, have drills from 16 to 20 inches apart and sow the seed about one inch deep. Quicker results, of course, will be had from seed sown in the house, and the plants set out about a month later. You can thin as needed so that plants will stand six or eight inches apart but for early beet greens and young beets they can be closer. Nitrate of soda well worked in will help you to get quick results. One hundred pounds per acre is a good proportion.

Sugar beets for stock feeding should be sown about the middle of May on good, rich soil. Keep free from weeds and cultivate thoroughly. Twelve or fifteen pounds of seed to the acre are not too much. Too much moisture is not good for the sugar beet crop, unless where planted on high, well drained land. Plenty of sunshine and warm weather are necessary for the ripening of any sugar producing plant. Yields of sugar beets are not infrequent of 1,500 to 2,000 bushels per acre.

Sugar beet tops make especially good spring greens.

Growing sugar beets requires a large amount of skill and experience as well as good, rich, mellow soil. Manure well in the fall, plow under early in the spring. Plant from about May 20 to June 20. Cultivate often, every three days is not too often and every two days is better. Leave from three to six inches apart in the rows, and row three feet apart for horse cultivation. If the summer is dry at the end, keep up cultivation until very late in the season.

Sweet Corn.

Sweet corn can be planted like peas, in a succession of plantings. For an early crop try Peep o' Day, next Golden Bantam, then Country Gentleman. For a late crop, Stowell's Evergreen, which is recommended by the Department of Agriculture. If these are all planted at the same time in different plots they will come along in succession. But a little difference of a few days will be better.

Sow in rich ground three feet apart, as soon as the corn planting time comes in your locality. Put in seed two inches deep and about six to eight inches apart. You can put it in thicker, thinning out to a foot apart later. If the corn is planted in hills, put about six seeds in the hill, and keep three feet apart. Cultivate much and often, until well started. Then thin to four stalks in the hill. Corn must be cultivated often, however, until the end of yield, though not very deeply at the last. The ears of late sweet corn may be kept in fair condition for some time after frost comes by cutting and shocking the stalks, and protecting the shock from drying. As fast as the ears are gathered, however, before frost comes cut the sweet corn stalks. This gives the other stalks in hill or the row more chance to mature.

Garden Peas.

There are some fifty varieties of garden peas and these have several classes: the dwarf, extra early wrinkled, extra early round, and the later, main crop variety. The extra early, for a northwestern

climate is uncertain; the dwarf is usually reliable, but the large Telephone peas for a late spring climate are always to be chosen. A rich, sandy, loam soil for peas is fine, though a clay soil may be used to advantage, except that the crop will be later.

When planting have open furrows three or four inches deep and three feet apart, scatter the seed peas in, cover with the hoe, or the plow, according to convenience, and cultivate like corn or beans. The tall kinds will need support and may be planted in double rows. The very dwarf peas may be planted a foot apart, need no brush or support, but must have the very best soil they can get for good returns.

If a continuous supply is wanted for the garden, plant every ten days or two weeks during the spring months, beginning as soon as the ground can be worked. If gathered very young, the pods can be used like snap beans.

In northern climates it is not best to plant garden peas in the fall. Fertilize the ground for peas thoroughly with rotted manure in the fall and plow or spade the dressing under. In the spring you can plant very early by raking or harrowing. In the far south peas are grown during the entire winter.

Beans.

Some gardeners say that they can grow good crops of beans on poor land, but this is a mistake. You can raise fairly good crops of beans on almost any reasonably porous soil, with a fair amount of fertility. But the best soil for beans is a sandy loam. If the soil is a too black loam too much straw is the result.

Do not plant too early, but begin about May 1 and continue on until June 10. Beans cannot withstand frost well, and corn-planting time is the best for dropping them. In fact, a little after the corn-planting, is apt to help rather than harm, but not so late that the autumn frosts will get them.

Plow the ground in the autumn or else early in the spring. Turned over sod—clover, timothy, or blue-grass—makes an ideal bean soil. Work it over on the top occasionally to germinate and kill weeds and keep the ground moist. In overturned sod there is much less likelihood of weeds, and the decayed plant food holds moisture.

Plant the seed with a bean drill or an ordinary grain drill from 28 to 30 inches apart, and about 2 inches deep. From 6 to 8 quarts of seed per acre is a good allowance.

Cultivate with a slant-toothed light harrow, as soon as the beans show. If you can, use this a second time. The rest of the cleaning may be done by a cultivator. After bloom, do not touch. The best machine for harvesting large crops is the bean harvester, which cuts the stalk off just above the surface of the ground. Do the work in the forenoon, and the beans can be thrown in heaps later.

Thresh beans with a thresher made for this purpose. Or the ordinary grain separator may be used if some of the teeth are removed.

Twenty bushels per acre is considered a good crop, and thirty-five bushels a large one.

Bean straw and unsalable beans make good sheep fodder. The greatest bean-raising section lies in Central New York. There I have seen clover-sod turned over in the fall of one year, after two crops that cut about four tons of good hay to the acre. The next year this was plowed and fertilized, with twenty-five loads of manure per acre and from two to four hundred pounds of phosphate drilled in with the seed bean. In this way, from thirty-five to forty bushels of beans per acre is a frequent return. Bean elevators are very numerous in Monroe and Genesee counties along the railroads. Thousands of women are employed here sorting beans. Five cents per pound for all the poor beans pays them at least $1.00 per day. These are sold to the farmers for stock purposes.

Bean stubble makes good land for fall and winter wheat. Eight to twelve quarts of medium red clover seed, when it is not mixed with other grass seed, sowed on this land the following spring will give two crops of hay averaging from 3½ to 4 tons per acre.

Rows of beans should be far enough apart to be cultivated when they are ripening to get perfect beans. A heavy clay soil is not favorable for bean culture. The bean does not take much value from the soil, and it can therefore be used to advantage with other garden crops, or it can be planted at intervals of about ten days until you have two or three plantings. Should the first planting be lost from frost, the second one will be likely to be all right. Replant the one lost, and continue to plant for all the first half of summer. Dry beans, such as kidney, or marrow, may be planted in the cornfield along the hills after the corn is up and has been cultivated once or twice.

Lima Beans.

Lima beans need a good soil and a sunny spot. Plant when the ground is warm, in rows four feet apart and six inches space in the row. If you plant in hills, put three or four beans in hills three feet apart. A top-dressing of poultry manure, wood ashes, fertilizer or compost around the plants will greatly hasten growth and improve quality of yield. If lima beans are planted in a too heavy soil, however, and the season is very wet, they are likely to rot. In that case the best thing to do is to replant at once.

Plant with the eye of each bean downward. The dwarf limas are a good variety, because much easier to take care of. Among these Burpee's bush lima is a standard. The pole limas will be helped along by applying liquid manure once a week until the pods begin to set. After that apply once every two weeks. Tie the vines to the poles about every ten days, if they don't twine well, and cultivate often.

If you want lima beans for seed, select those that mature first at the bottom of the poles, even if the pods do not hold four or more beans. Earliness is a greater requisite for seed purposes than the size of the pods. Choose seed from the heaviest bearing vines, also. Keep watch of pole limas to see that the lateral shoots are kept properly tied. The varieties of lima beans do not make much difference

in the time of maturity, but pinch off the tops as they reach the upper end of the poles. This will increase the number of laterals and help the blossoms to develop. The first of August is about as early as lima beans may be expected.

Wax beans or string beans should be gathered clean as soon as fit for use. This keeps the plants bearing longer. They also may be planted again and again until six weeks before frost is due. Cultivate and hoe very often, but only when the vines are perfectly dry. In hoeing draw the soil up towards the plants.

Anthracnose, or rust, on wax beans, is apt to be found more in damp seasons. The spores remain in the soil so that it is often best to select new ground for wax bean growing.

Cucumbers.

The gardener who wants to have success with cucumbers should get Farmers' Bulletin No. 254 on "Cucumbers." For very early cucumbers the hotbed is necessary. Sow in March or April 1. Transplant to a moist, rich loam, in hills four by six feet apart. Several plants, at least ten, can go in a hill, but thin out to about four when they throw out runners. Cultivate well and gather before they ripen with a sharp knife, whether you need them or not. They can be planted in succession. For pickles, from June until the middle of July is the season. The Bordeaux mixture is usually needed for the cucumber beetle. Put it on the vines with the sprayer in proportion of three ounces to the gallon.

Cucumbers rarely do well on old land. One large grower whom I know tells me that he clears up every year three acres of his land so that he may have fresh ground. On this he puts a large quantity of fertilizer, and cultivates thoroughly, harrowing both ways. By hilling up and using poultry droppings on each hill, he gets large yields for the factory, and has realized handsome profits. Two hundred bushels of cucumbers can be grown on an acre of land.

Another cucumber grower gives this advice: In light soil do not put cucumber seed in hills. Make a hollow about fourteen or sixteen inches in diameter and space the land in six-foot marking so the plants will absorb rain where, if planted in hills, the water would run off and away from the roots. The quantity of cucumbers merchantable depends upon the number of times the fruit is picked, which should be often.

Cabbage.

Farmers' Bulletin No. 433 should be read by every cabbage grower, whether for small or large plots. Cabbage needs a very rich soil. In fact you can hardly get too rich a home for your cabbage plants. For outdoor seed sowing from April 15 to May 1 is the usual time. Plant for fall and winter cabbage from the first to the tenth of July. If you are growing for commercial cabbage raising, and your soil is poor, a dressing of sixty tons of manure per acre is advised, and this should be well rotted. Turn this under in very narrow furrows, in order to break up the soil fine. Harrow several times and set

plants in rows two and one-half feet apart and two feet apart in the row.

Brussels sprouts and cauliflower are grown exactly like cabbage. The small moth which attacks cabbages can be coaxed away from the cabbage by growing millet around the cabbage patch.

A cabbage crop planted where the hay crop has been poor, and has been cut early, will often prepare the soil well for the next year's corn, as well as give you a late cabbage harvest that will go far to make up for the loss in forage crop. Cabbages are as good as roots for feeding stock and may be left out till very cold weather is near.

To keep cabbage through the early winter, standing in the ground, the gardener usually pulls the cabbage enough to break the main roots, when they begin to burst. This will stop the growth. Then either plow or dig in dry land a trench two feet deep and eighteen inches in width. Scatter six inches of loose straw in the trench. Then place the cabbages in the trenches heads down. Leave all leaves and roots on, and bury the first layer thoroughly in a heavy covering of straw—with dirt over this, then more straw and more dirt. This will keep your cabbage fresh and free from frost even in zero weather. The same method can be used for potatoes, mangelwurtzels, beets, turnips, carrots and all kinds of root vegetables. Dig the pit a little deeper, fill with vegetables in a layer, put on straw two or three feet thick, follow with dirt, then eighteen inches of straw, then dirt thickly and heavy covering of stable manure. This keeps the crop for the spring market.

Pumpkins.

Pumpkins can be planted with corn, putting a seed in every second hill of every other row. However, other and easier methods are often followed. Pumpkins as stock food for hogs are excellent. They are great helps in securing a balanced ration, and are a splendid cholera preventive. By carefully selecting the seeds as to size, quality and thickness, planting with horse planter, well mixing seeds and corn together in the planter and giving only such attention to the cultivation of the pumpkin as the corn field gets, a fine yield of prize pumpkins can be had with less work than by hand planting. It should be remembered, though, that some horse planters will not plant pumpkin seeds.

Keep the best of the pumpkins for seed, dry them well, and use for next season's planting selecting only the best seed. Pumpkins can be left out in the field until freezing weather. Then haul to the hay mow the best and soundest and keep for late feeding. The others, even if frozen in the field, will be eaten by the hogs, after cutting up by the ax. Hogs never tire of them.

Many farmers object to the planting of pumpkins with corn. They think they are a damage to the corn crop, and always advise either planting pumpkins by themselves or raising them in the potato field. If this last way is adopted put in the seed every sixth row, skipping from ten to twelve hills. This method does not injure the potato crop at all.

If pumpkins are planted in hills by themselves, plant eight feet apart each way, and cultivate well. They are much sweeter.

Egg Plant.

The culture and general treatment of egg plant are about the same as for tomato plants, though they are not so easy to grow. Plant the seed in a hotbed or in the kitchen in early March; or small plants may be bought in the cities at this time. Set out in a deep loam soil, which has been thoroughly plowed and is well drained, when the plants are from six to eight inches high. Set two feet apart each way and water freely until the plants are well set. About fifteen plants are enough for a good sized family. Cultivate often and thoroughly. You can begin to use egg plant when it is only half grown, and it can hang on the plants for some time without losing its food value after ripening.

However, in growing for market, in order to be pretty certain that egg plant will prosper, after the early sown seed has developed its first leaves, transplant to pots before setting out in open ground. Or, if you buy your plants be sure to buy in pots and not in boxes. Grow in hills of sandy loam, well fertilized with market fertilizer mixed with compost. Cultivate very often, but do not keep the ground moist. A dry soil is best. The hills should be about three feet apart for the standard variety, about two for the dwarf kind. Each vine should yield three or four fruits. After these are set pick off any further blossoms and nip off the end of the vine. For market use the dwarf black comes earliest. The white is a good variety for home gardening. Seeds can be planted outside the first week in May, if kept from chilling in a warm and even temperature.

Melons.

The muskmelon season is apt to be a short one in all sections north of the late and early frost belts. This fruit must be up and growing well by the last of May in order to escape fall frosts. Select a light soil for your crop, if possible. The hills must be specially prepared in heavy soil. Make holes five feet apart, one foot deep and about a foot and a half each way. Fill in the bottom with about six shovelfuls of soil and manure (poultry manure is specially recommended), well mixed together. Press this down hard with the feet and add a layer of about two inches of pulverized soil. Sow the seeds on this; cover with about an inch more of soil Use plenty of seed—fifty is not too many. Thin to about eight or ten, after the second pair of leaves come. After they start to vine, you will not be troubled so much by the insects that attack the plants just as they appear, and you can pull out all but three or four of the strong plants. Don't try to raise pumpkins and muskmelons at the same time, as the pollen mixes. If the season is a late one, liquid manure each week and removing all the fruits that set, over the first half-dozen of each hill may help in forcing growth. Pinching the ends of the vines after they reach three feet is also good. A light applica-

tion of bone meal worked into the hills will help greatly. This is true of other vines also.

Watermelons always succeed best when the season is hot and dry. Look out for cut worms in time and try air slacked lime around the plants. Sometimes a little worm that develops from the striped squash bug eats the roots of the vines. For these the lime is good. For the cut worms try wrapping the young stems with heavy paper stuck down about two inches into the soil.

Celery.

No better or more complete directions for growing celery can be given for beginners in celery raising than those found in one of the Bulletins of the U. S. Department of Agriculture, and written by W. R. Beattie. Mr. Beattie says that, "for early celery, throughout the northern states, a planting should be made in the house during January or February, but for the main crop the seed may be sown in a frame or hotbed, or in the open ground six weeks or two months later. In the latitude of Washington, D. C., good celery can be grown from seed sown as late as the middle of May, and to the southward still later.

"For plants from which the main crop is to be planted, sow the seeds in a cold frame or in the open ground. Several methods are in vogue for starting celery plants in the open ground, and the one selected should depend entirely upon the scale on which the crop is to be grown. One plan is to sow the seed broadcast in a bed about three feet wide, and of any desired length, from which the plants may be transplanted to another similar bed, and again to the open field, or they may be thinned and allowed to remain in the seed bed until the time for setting in the open ground where they are to mature. Another method is to sow in drills, 10 or 12 inches apart, and cover very lightly by sifting soil, or by passing a roller along the drill after the seed has been dropped. When the seedlings are well started they may be thinned out and allowed to remain until planted in the field. Plants grown in this manner require very little attention, as they can be worked by means of a wheel hoe or other hand cultivator.

"The method now in use by most large growers is to prepare a tract of land by pulverizing with horse tools and then raking by hand, after which the seed is sown broadcast by means of a wheelbarrow grass-seed drill. The soil is sometimes pressed down with a plank after the seeds are scattered, but some growers maintain that there is a decided advantage in leaving the soil slightly uneven, as the seeds fall into the shaded places and are protected from the direct rays of the sun. The seed will become sufficiently covered by rains or watering. Should more than 20 per cent of the seed usually sown germinate, it will be necessary to thin out to prevent overcrowding, with its attendant injury. To prevent the surface of the soil becoming too dry, it may be necessary to partially shade the young plants during the warm days of early summer, but the shading should never be so dense as to cause them to become 'drawn.'

"Cultivation should begin just as soon as the newly set plants recover from the shock of transplanting and continue in the form of level tillage until early September. At that time the 'handling' operation may begin, which consists in drawing the loose earth up to the plants with a hand hoe or throwing it up about the plants with a celery hiller or shovel cultivator. This causes the plants to grow more upright and facilitates the work of blanching.

"If a very rich soil is had, and means of applying water is convenient, a portion of the celery crop should be grown by the 'new method.' This consists in setting the plants six inches apart in rows ten inches distant. The plants soon occupy the entire area, while the tops cover the stalks to such an extent as to shut out the light sufficiently to blanch them without the aid of boards or soil, as is necessary when the crop is grown by the old method. Soils not rich and moist are unsuited for the new method, but those in a high state of cultivation and with facilities for watering will yield stalks as good, if not better, than those grown in the usual way.

"There are a number of ways to bleach celery, but the easiest method to follow is bleaching with boards. Anything that will exclude the light from the stalks will cause them to crisp and whiten. Heavy paper wrapped about the stalks or a tile pipe placed over each plant is as satisfactory a method as any in the home garden where only a few plants are raised. Celery bleached by banking earth up about the stalks is by far the best, but usually it is better to sacrifice quality for the extra labor incurred. When celery has reached its full size or nearly so it should be growing in an upright direction from the earth that has been pulled toward the stalks during the past few weeks. To whiten the plants and fit them for the table two ten-inch-wide boards should be set upright, one either side of the row and running lengthwise with it close to the stalks. By passing a wire about both boards at intervals of every ten feet or so the boards will be held in position. If there are any open spaces between the earth and the boards, soil should be banked up sufficiently to exclude all light. The tops of the plants ought to be left sticking out between the boards and enough space left to allow the plants to continue their growth. It requires the stalks from ten days to three weeks to bleach."

Storing Celery.

November is a good time to dig the table celery for storage. Celery intended for this purpose need not be bleached. Draw the earth up against the plants so that they will keep upright. When the nightly freezeups come dig your trench so deep that the tops will be covered, and about a foot wide. Put the plants close together in this, slanting a little from the perpendicular, and having the soil loose at the bottom. Put them in rows and throw a good amount of earth over each row of roots before putting in the next row. Cover trench with a layer of boards crosswise, leaves over this and soil upon the leaves as cold weather advances. When you have from eight inches to a foot of soil above, cover the soil with long manure. Green va-

rieties of celery will keep until late in the winter or early spring, if in perfect condition when stored. The white stalked sort will keep two months or so. Celery for late fall use, in a moderate climate, can be left out in the garden until almost New Year's, if well banked with boards or earth.

In fact, as a general rule, leave the celery in the ground, in a dry soil, until you get temperatures of 12 degrees below freezing. In a damp soil from three to four degrees. To take it up, plow a furrow from each side of row and loosen with spading fork if quantity is large; if small, use spading fork only. It may be stored in boxes in one corner of a cave or in cellar in trenches. In whichever way, a little dirt or sand around the roots to keep them moist is plenty. Give plenty of fresh air and light occasionally if wanted for family use, but if for market keep in dark, warm place and it will bleach out faster.

When celery begins to rot in the trenches, look it over carefully and use up the decaying stalks as rapidly as possible. The sound ones can be retrenched if there is enough to make that desirable.

Nitrate of soda applied at the rate of about 150 pounds per acre is excellent for celery growth. Use it at least twice, at about a three weeks' interval, after plants are well started. Sprinkle lightly along one side of each row and cultivate well afterward. But in cultivating celery be careful not to disturb the roots of the plants during their early growth. Shallow and frequent cultivation is best.

Miscellaneous.

Salsify, or oyster plant, can be grown with good success, as it is very hardy and is improved by freezing. It should be planted in rows sown thickly, in loose, mellow soil, and covered not more than three-quarters of an inch. The fleshy, tap root is the edible portion. If it sends off shoots from the root the ground is not right. Cultivate well and keep ground moist and rich. It will grow until late in the fall, and unless winters are very severe, can be left out through the winter sending up good stalks the next spring. If very far north the roots can be pitted.

Parsnips need a deep, rich soil, well pulverized. Sow in rows about 18 inches apart and about an inch deep or a little less. Weed carefully as they appear and cultivate often until about three inches high. Then thin to six inches apart. Parsnips need constant cultivation. They are improved by freezing, and can be left in the ground through the winter, after taking out what is needed for the winter. Or they can be stored in pits.

Carrots for early crops, short rooted, should be sown in April or May in drills a foot apart. A rather light soil will do fairly well for carrots, but it must be warm and fertile. Thin to about two inches. For a main crop of the longer rooted variety, sow in succession from May to July 1st and row from 16 to 20 inches apart, thinning to from 2 to 4 inches.

Water cress must be grown in running water, or in a pond with inlet and outlet. Seed can be sown in July or August by drawing

out the water from the bed where they are to be sown. Sow at right angles to the course of the water, and six or eight inches deep. Scatter seeds in the bottom, and do not turn water over them again until they have begun to grow.

When cuttings or old plants are used they should be planted in the bottom of the bed a few inches apart previous to allowing the water to flood the beds. The cuttings should be tied to stakes and the stakes stuck into the bed. This method is followed in the Atlantic states.

A simpler method, which has met with success in the West, is to sow the seed in cool, moist soil in the early spring, or if a shallow, slow running stream or ditch is near, the seed may be sown within the same near the bank. When sown in a location of this kind it grows luxuriantly for years.

Sow parsley seed in shallow drills in the early spring as a border for your vegetable plot. If later in the season, and it is wanted for winter use, sow in good soil in a box, in rows about six inches apart, and cover one-half inch deep. Keep moist, and when the plants appear about two inches high, thin to two inches apart. This box can be kept out until late in the fall, and when in the house should be kept in a sunny window. Sprinkle frequently to keep away plant lice.

Wintering of Vegetables in Cold Climates.

There is a tremendous loss by growers of vegetables during the winter, either because of the lack of knowledge of how to keep them or because of carelessness. It is a well known fact that at certain seasons certain classes of produce are a drug on the market and prices are correspondingly low. Now if it were possible to preserve these until late winter or early spring a surprisingly good price can often be secured. This very thing can be done, and done as successfully here as it can be back east, by following out the instructions given below.

Choose a location where no surface water collects, preferably a mound or side hill and let this be protected, if possible, from the bleak winds. Now dig a pit 3 or 4 ft. in depth by 6 to 8 ft. in width, and make it long enough to accommodate the vegetables which are laid in to within 6 inches of the top soil. These are then covered by 6 inches of hay or straw. Over this, but not resting on the vegetables, planks or poles are placed to provide the air chamber, and these in turn are covered with more hay or straw to a depth of 4 ft. and extending out about 6 ft. on all sides. Next, 12 or 18 inches of dirt are placed on this straw and the whole rounded off to shed any water in case of thaws in winter. On top of this, as an extra precaution, are placed 3 or 4 ft. of horse stable litterings, packed very close.

All kinds of vegetables can be kept from freezing when taken care of in this fashion and they will be as fresh in the spring as they were in the fall, and will bring far higher prices.

If it is thought necessary, a covering of tar paper or "ruberoid" can be placed on top of the planks before the second covering of straw is put on.

Vegetable Pests—The Cutworm or Grub.

There are two kinds or species of these cutworms. One is dark in color. The other is a yellowish white. The dark colored one does his work by cutting the plant off just above the ground. They will often cut a number of plants in a very short time. Sometimes they can be found concealed in the dirt near the plant they have destroyed. The light colored ones do their work in the ground, sometimes about an inch or more under the ground. They cut or eat plants the same season until the plants are quite large. As a general thing they are found by removing the dirt from the plants they have lately cut off. I have known of farmers in the East going over their corn fields and digging the worms out from under the hills of corn. Sometimes there would be from two to six or eight in a hill. This course would insure a good crop of corn. Wood ashes and land plaster put on corn before it comes up is a good preventive.

Salt is good, sown from five to six bushels to the acre before the crop is put in, if you want to keep the worms from garden plants. When planting cabbage, tomatoes, or plants of this order, put a piece of paper loose around the stalk of the plant. Let it go down in the ground an inch or two, and above the ground the same number of inches or more. This will keep off the cutworm and prevent any serious harm.

Crows are worth their weight in gold to the farmer. They pick up and eat off worms and grubs. One of the best farmers that I know shelled corn on his cornfield, after planting, for the crows. He would sow a few quarts over the field, and if they were liable to eat this up before the planted corn got too big to pull, he would shell and sow more corn for the crows. While the crows were feeding on this corn they were picking up thousands of worms that destroyed crops. Every bushel of corn that this man sowed on his cornfield for the crows, was worth five dollars per bushel in the long run. Laws for the protection of crows would be a safeguard for the farmer. It would be better for all of the people if there were more crows and birds in the country.

In gardens where the cutworms are very bad, a good method is to place blocks and chips of wood around among the vegetables. In the morning these may be turned over and large numbers of worms killed. They would rather hide under such things than dig down into the ground. They evidently detest work as well as some men.

Probably the best remedy is the use of poisoned grasses, cabbage leaves or clover. Make a Paris green or London purple solution, say a tablespoonful to a bucket of water. Saturate the grasses and in the evening scatter the poisoned material between the rows. The worms will eat this and die.

Always use the necessary precautions in handling poison.

One part of Paris green to twenty parts of wheat shorts, spread on the surface of the ground and covered with bunches of green

clover or other grass will also kill cutworms. Plowing the garden in the fall is also recommended to get rid of these pests.

For cabbage worms, one ounce of Paris green or London purple to six pounds of flour, dusted on the plants when wet with dew is a good preventive for young plants. Pyrethrum powder, dry, is recommended after they begin to head. The ordinary flour used for domestic purposes can be made effective here. Hot water at 150 degrees has also been recommended, used as a spray. Slacked lime is also a remedy.

Young tomato plants have one enemy that, if left to do its work unchecked, will soon sap all the vitality from the plant. This is a tiny black beetle often wrongly called a fly. It does not trouble the plants while they are in the house, but as soon as set out of doors, even while they are in boxes before being transplanted to the open ground, the beetles appear in great numbers, and in a few days will work great havoc.

When the pea vines are wet with dew dust with powdered hellebore for worms. A few worms can be picked off.

Snails that attack tomatoes can often be trapped by leaving slices of beets, turnips or like root vegetables among the plants at night. An early morning's visit will insure finding many of the pests on the slices. Orange peel used in the same way is said to be even better, as a snail will keep on feeding on this after light comes instead of going to its hole.

The borer of the squash, pumpkin and other vines is best fought by catching the moths, which fly only by daytime. They are about an inch long, of a peculiar tint of olive green, and may be found after sundown on the upper side of the leaves near their base. A good way to cheat the borer is to allow the vines to form new joint roots by covering the joints with soil. Keep looking for the borers also at the ground near the base of the plant, and dig out with a knife.

CHAPTER IX

Corn and Small Grains

Corn Planting.

LAND intended for corn planting should be fall plowed and then must be surface worked very early in the following season to prevent the formation of lumps and crusts. Deep plowing comes a little later, followed by double harrowing and planking or rolling in order to produce a level surface. Plant about the middle of May, and use the drill method with the horse planter, if you are willing to cultivate often, in fact, almost constantly at first. If not, then the hill plan takes less attention, but also returns less yield. Row north and south. If the field has been made ready, as it should be, before planting, use the smoothing harrow afterward. If it is lumpy, cultivate both ways. Then harrow every three or four days until the corn is up. Sometimes, in the case of heavy rains, the field will need cultivation oftener. After the corn shows, the weeder, used at least every week, twice a week is better, follows. After that the surface cultivator. If rain brings up the weeds too fast, the shovel cultivator may be used until the corn is six inches high.

Sow in season, therefore, upon your well prepared seed-bed only the best and tested seed which you know to be well suited to your locality. Northern grown seed corn, potatoes and fruit trees are the only seeds and plants to use in the North. Southern seed corn can be used, though it will not ripen the first few seasons. But by selection of the ripest ears each fall a very good and adaptable corn can be grown in time. When hardy seed, however, can be had right at hand, why not use that? Then, by eternal vigilance, cultivation and selection improve this each year. This is the only way to get bumper crops. Corn with less than about fifteen per cent. of moisture does not germinate while in storage.

The corn crop in 1908 was 2,668,651,000 bushels on about one hundred millions of acres. This means an average per acre of only about twenty-six bushels.

The distance for planting corn in any particular soil should be fully decided on before adjusting the planter, and after planting and adjusting for accurate and regular planting do not plan for thinning out later. This work must be done by hand, and for large fields this is too expensive as to labor. If the seed has been properly tested it should show a germination of 95 per cent. Given seed of this quality and proper planting the stand of corn will be all that is desired in any ordinary corn-growing weather. If the season is very unfavorable to growth after planting in the most careful manner it may be best to

replant again, instead of trying to fill in vacant spots by hand planting.

The soil for corn should be rich in plant food. A good fertilizer is ordinary barn yard or stable manure and potash. I would recommend using about four loads of manure and 100 pounds of muriate of potash per acre. Scatter this broadcast and harrow it in. I believe this is the best method.

The planting should be done as soon as the danger from late spring frosts is past and the weather settled. Plant as early as possible in May. Do this for several reasons:

First. To conserve the spring moisture; corn uses water enough to cover the land it is grown on 10 inches in depth.

Second. Should the crop be a failure due to frost, drouth, poor seed, or worm-eaten seed, it may be replanted and come out all right.

Third. For early planting the corn will mature and ripen before the early frost in the fall.

When planting in hills to be rowed both ways, plant in rows from 4 to 6 feet apart, and plant from 4 to 6 feet apart in the rows. This mode of planting will cause the stock to bear a greater number of ears and will be much larger in size of ears and kernels, and the small ears called nubbins will entirely disappear. Also this method of planting will supply more moisture and sun, and therefore the corn will ripen more evenly. There should be in every hill from three to four good stalks in order to secure a large and paying crop.

Cultivation.

This method of planting makes cultivation easier and also the moisture is retained in case of drouth. The cultivation should begin in about three days after the planting and be continued until the ears on the stalks are all set. For the first cultivation use a weeder machine, then a cultivator. In the rainy season it will take from 12 to 24 hours usually for the weather to settle and the water to run into the ground, then begin the cultivating. This will form the reservoirs for holding the moisture during a continued drouth, and the only way to hold the moisture is continued cultivation throughout the entire season. The last deep cultivation should be from three to five inches deep, so as to hold the rain fall.

Do not allow any weeds in your corn fields, as they are great robbers of plant food and moisture.

If farmers plant and care for corn after this method it will revolutionize the corn growing of the country.

Potatoes should be cultivated in the same manner, and the cultivation should continue until they ripen or until very late in the autumn.

One suggestion as to corn breeding that should be made is not to put too much stress on the regular rows of corn in an ear at the expense of utility. Large yields of sound corn are what the practical farmers wants for stock feeding. Let the specialist attend to the matter of regular kernels. But the man who is working for commercial

returns needs to put his efforts into getting rid of rank stalks and growing his seed corn on special patches where he can develop good points. Corn breeding is needful, but don't go off on a tangent about it.

Cultivating Tools.

For shallow working in fields of growing corn, when the plants are a foot high, the combined implements which can be quickly changed to four, six and eight shovels and have surface working attachments and blades are the best. The set of ten small shovels is good also. All these are now sold at a reasonable price. By the use of these, working the soil two or three inches deep, cultivation late in the season can be done to satisfaction. Any cultivation which gives the outside roots air and sunshine is always needed for corn. Never hill up corn but work with the cultivator as close to the stalk as possible without tearing the stalk until corn is at least two feet high. Then throw up a little dirt to keep down weeds and cultivate as level as possible after that.

Care must be exercised on early cultivation that the roots of the corn be not hurt or pruned off. It has been proved that if the roots are cut off to a depth of 3 inches and 6 inches from the hill that the crop is damaged 6 bushels to an acre—if cut 4 inches from the hill the damage done reaches 18 bushels. Any method of cultivation which does this should be changed.

A weeder is an essential on a farm. For the cornfield it should be put in as soon as the corn shows above the crust of the earth. Use it on sowed grain as soon as it is up from three to four inches. One farmer tried it successfully May 6 on oats just well above ground, which had been sown on fall-plowed land. Run the weeder first across the drill rows and then the same way that the grain was sown. Set just deep enough to stir the surface of the ground without disturbing the grain roots. By going over twice the entire surface of the soil is stirred.

Field Corn.

Field corn should be planted from two and a half to four feet apart and four spears in a hill is a great plenty. Work as soon as the hills can be seen. Stir the dirt with a weeder when the corn is very small. The more stirring up of the soil the faster the corn will grow. Do not hill too much nor put in too much seed. Level and flat cultivation is the best for corn. Cut as soon as thoroughly glazed and shock in good sized shocks.

But if it is to be put in the silo it should be cut as soon as it commences to glaze and put directly into the silo. Silo corn should be rowed north and south, and planted about twice as thick as for husking. The land should be heavily fertilized; twenty or twenty-five loads of manure to the acre on good land, but poor land will need forty loads per acre. Plant the ordinary field corn from the middle of May to the middle of June. Four days after planting use the weeder and continue its use until the corn is three or four inches high. Then cultivate thoroughly.

For silo twenty-five feet in diameter and forty feet high, two hun-

dred tons will be needed. The large evergreen corn is good for silage. The silo preserves both the stalk and the ear, and the ensilage settles in about twelve days. For labor reckon one man and four horses to cut the corn, six or eight men with teams and wagons to haul, one man to feed the machine and one in the silo.

Sweet or field corn intended for fodder can also be stacked in the fall by sprinkling into a load of corn a quart of salt or more. Then add one-half a load of good dry straw to the top of the load of corn. Smetimes it is better to lay the butts of the corn or corn fodder all one way. The top of the bundle is not so apt to heat. In the middle, where the ear is, there is the most danger from heating.

It is very important to cut corn at just the proper time, if both the stover and the grain are to be used for stock food. For stacking cut shortly after the kernels are well dented and the leaves begin to dry, but do not let the ears get ripe. For silage the kernels must also be well dented and just beyond the glazing stage. At this time the stover is at its greatest food value and yield. But left until the grain is perfectly ripe the stover value decreases.

Fodder Corn.

All fodder corn for daily rations should be planted in drills from 3 to 4 feet apart. The rows should run parallel north and south and be well cultivated. By exposing the growing corn to the sun as much as possible there will be more nutriment for the dairy cows. Sixteen quarts of seed per acre should be enough for this method.

Fodder corn will grow almost anywhere in the northwestern states. From six to eight tons of cured fodder per acre can be raised where only one and a half or one ton of timothy or prairie hay will grow. Common field corn gives the best results and grows the best. Plant from about May 20 to the middle of June in single or double rows at the rate of about twelve quarts per acre. A common grain shoe drill or corn planter with drilling attachment for planting can be used. Harrow after the corn is planted, and even when six inches high, with a light harrow or weeder. After the corn is up, however, the harrowing should be done in the middle of the day when the stalks are tough. Harrowing in the morning is likely to break off some of the stalks.

Cut before frost or, if frost catches it, a day or two after. If left longer after frost it will become dry, lose many of the leaves and a large portion of its nutrient value go back into the roots.

Corn fodder is equal to the best of hay if it is cut in the proper time and cured.

A Home-Made Fodder Cutter.

No one will question the value of cut fodder for stock, and especially for horses, although many farmers will not use it because of the labor involved in preparing it. The home-made cutter will do quite as good work as the more expensive machines and it really does not take much time to prepare quite a lot of fodder. To make this machine, two boards, each one foot wide and five feet long are re-

quired. Nail these together in V-shape, then make the legs of pieces three feet long, nailing a strip across each, as shown, to keep them from spreading. Have the blacksmith make a cutting blade; it may be formed from an old scythe, arranging it so that a place is reserved for the handle and that the cutting portion is about two and one-half feet. Bolt a piece of iron at one end to one leg six inches below the box and bolt one end of the scythe to the other end of the iron, arranging them so that both will work easily. Lay a strip of iron against the top of the other leg, with space for the scythe to work in easily. The downward slanting motion of the scythe when in use will cut the fodder readily if the blade is kept sharp, as it should be.

Seed Corn.

We predict that next spring will find a large per cent of the farmers without good seed corn. We say "good seed corn," for the late ripening followed by early frosts has very materially reduced the available supply to select from; and added to this the extreme lateness of fall work will prevent a great deal of this being gathered and dried out, before freezing weather. This means weakened vitality, and much that will not germinate next spring, and a poor stand will probably follow. There has never, since corn has been grown in Minnesota, been a better stand than during the past summer. There was no other cause for this than the extremely early ripening of last year, which rendered the corn mature, well ripened, and thoroughly dried, long before the setting in of freezing weather. It is a well established fact that any amount of freezing will not injure the germinating qualities of thoroughly dry corn. If the freezing and thawing of late autumn comes as usual, the average seed corn will contain too much moisture for its germ to withstand the destructive effects of freezing and thawing, and as a consequence we shall have no end of fields next year that will show a very poor stand. The only alternative seems to be to follow the practice of the old corn raisers, and select the seed at once, put it in the chamber over the kitchen, and give it as much sunlight and air as possible, or better yet, hang it up on the kitchen ceiling for a time; this may be an annoyance and inconvenience to the good housewife, but it means a good stand of corn next year and no matter how rich the land or how good cultivation is given, a good crop of corn cannot be raised without a good stand.

A very convenient plan of hanging up corn is to tie it with binding twine. Any active boy can string up several bushels per hour. It is done by simply making loops very close together and drawing them up to hold the ears. It can then be hung up in a dry place, and a good stand of corn for next spring is assured, and the vexation of trying to find good seed corn will be avoided, and $1.50 or $2.00 per bushel for seed will be saved.

The modern farmer pays more attention each year to the use of high grade seed of the best varieties. In many states they recognize the great need for improvement in this respect by seed growers' associations. The agricultural colleges are also teaching us a great deal in this respect. The farmer himself can do a great deal toward rais-

ing his own seed-standard by the careful selection of the best kernels from his products. Seeds vary from year to year, just as the children of a family do. Continued selection, therefore, is very necessary if the farmer wants to be sure of good crops. Cut out the tips and butts of the seed corn ears. Corn taken from the middle of the ear germinates and grows faster, and will give a better yield than that grown from the grains at either end of the ear.

Good Seed.

A writer for an agricultural journal has the following to say about seed corn:

"There has been a great deal said in regard to good seed and various ways have been devised as to how to secure the best, so I will give my way. When the crop is about right to go in the shock I go through my field, and from good thrifty stalks, I take the best ears and husk and hang in an open shed or building until thoroughly dry, when I put away in a bin or in boxes.

"Still, I have had good results by leaving it hang from fall until planting time. Last spring I got a good stand the first planting, while most of my neighbors planted from two to three times.

"Another point. Some seven years ago, I sent to a seed company in Wisconsin for an early dent white corn, which proved to be the best investment I ever made, as it more than filled my expectations, but after planting a few years, it had considerable smut. I went to work to eradicate it in the following way, which proved a success. When in the field picking seed as stated above, I would not take an ear that was close to a smutty one, but far enough away so that I thought it had not had any pollen from a stalk that had a smutty ear on. And now my corn is almost entirely free from smut. I use the same plan in regard to barren stalks with good results. I hope this may be of benefit to some brother farmers."

Getting Good Seed.

The agricultural stations are especially insistent upon the selection of seed corn early. Go down the rows as the corn stands in the field, and select from the best stalks the ears of the best form that show a thorough ripeness. Slight frosts do not injure thoroughly ripened corn, so that the farmer need not hurry up the process of selection before the corn is well matured. Do not dry corn in the sunlight but store it in a dry place upon racks where it will get plenty of air. If necessary use artificial heat to dry before real cold weather sets in. Corn thus selected and properly tested will add millions of dollars each year to the yields of the corn-growing states. The Iowa agricultural station declares that every bad ear planted of seed corn means a loss of $6.50, and that $5.00 will buy a bushel of properly tested seed corn.

Buying Seed.

Why also do farmers wait until nearly sowing time before buying seed. A system of wholesale buying on a co-operative plan put into

action some months before the seed is needed, will save several dollars on the seed bill. Timothy bought in large quantities is of much better grade. All pasture grasses and orchard grass, red top, blue grass, sorghum cane seed, dwarf Essex rape seed, cow peas and soy beans can be had early. See that the seed you buy is clean, as well as bright and dry, and don't experiment with new varieties. Pay a few cents more a bushel for the best seed. You will get that back in many fold from your yield, other things being equal. And, let me add, that the farmer who buys the best seed usually has other things equal in his farming. Let the agricultural colleges do the experimenting and the farmer stick to the standard varieties of corn.

Testing the seed corn, says this same authority, is neither hard nor tiresome. It is done in the winter or early spring, when there is plenty of time. The hours spent in testing seed will do more toward getting a full crop than weeks of hard work in the field later in the season, for, no matter how careful the cultivation or how favorable the season, a full crop is not possible if the stand is poor or the vitality low.

It is the plants from the kernels with low vitality that are first affected by the drouth, by the heat or the weeds. These plants are responsible for more failures and poor crops than anything else. A careful germination test shows just what the vitality of each ear is. It shows more clearly than anything else what next year's crop will be. Record yields are not possible unless seed corn is planted that will produce plants with strong root systems as well as strong stalks. A glance at properly tested seed corn shows both the sprouts and the roots, and no seed should be planted that has not proven in advance that it is capable of producing a good ear of corn.

Testing Seed.

The farmer need not depend upon the agricultural college, however, for testing his seed. He can give the seed at home such conditions of heat and moisture as nature gives for outdoor growth. Fill only a small box with earth such as you use for potting plants, count a number of seeds to be tested, and put in the box of earth giving only enough water to keep moist, and keeping the box in a warm but not too dry place. Covering the box with a piece of paper or cloth will hasten germination. Take the sample to be tested from the mass of seed to be used, and this will test as to general planting. If a sufficient number of these seeds sprout and grow up with vigor, the seed selected for use will be right for profitable culture.

Another common method of testing a small number of seeds is to use moistened cloth or blotting paper; fold and lay on a plate, placing seeds within the fold, so as to keep moist; then invert another plate over the whole, keeping seeds warm and moist. Any kind of seed may be tested in this way, and it is very interesting to watch the experiment.

It has been figured that an increase of ten bushels of corn to the acre would add fifty millions of dollars yearly to the income of the Iowa farmers. Iowa devotes ten millions of acres to corn and the

average price is 50 cents a bushel. See what that would mean. Besides adding new wealth to the country, the product would be improved in quality. Other things being equal, these results could be accomplished by the use of only tested seed for planting. The farmer who puts great care upon the preparation of his land for the seed bed and the selection of the best time for planting can no longer lay the blame for a bad harvest upon poor seed, because tested seed can be obtained now by any one.

Corn Smut.

Smut in corn is a plant that grows from spores instead of seeds. Wet seasons and low lands are more likely to develop smut than the opposite conditions. But if the disease has once started, dry weather following will not stop it. If smut in seed corn is suspected immerse the corn for a short time in a solution of one pound of copper sulphate to one gallon of water. Rotation of crops, however, is one of the best methods of reducing the smut infection. By this plan corn can be planted on land likely to be free from the spores. The great danger from smut is not so much in its injurious effect upon live stock as in its effect upon the profits of the yield from the corn field. The spores are easily carried in the air or maintain their life through the stomach of an animal. For such and other reasons they distribute themselves rapidly, and smut corn is not therefore, a good diet for stock. Yet a little smut in corn is not of special harm where the yield is large. If you have a yield of 150 to 200 bushels per acre your seed corn will be all right, saved from this big crop. Save the best ears, and either hang up the braided ears to dry, or husk clean and spread out on the floor of any dry building. Good seed can be had from both methods.

The Corn Worms.

According to Prof. Wheeler, of the South Dakota Experiment Station, the corn worm, the corn-ear worm, and the cotton boll worm are one and the same. The worm varies in color according to what it feeds on, the mature insect being a medium sized moth, which lays its eggs at twilight upon any part of the plant. Corn, pumpkins, melons, red peppers, beans, peas, gladiolas, geraniums and some other plants are sometimes attacked by it, but its work on corn in the Northwest is serious, as it not only eats the young corn stalks, but later enters the ears and eats the silk. The color of the pest will vary from light green to black. Sometimes it is spotted or striped. The only sure cure is, apart from fall plowing, to destroy the eggs, to practice rotation of crops, using crops which the worm will not feed on.

Kansas farmers usually raise from 70 to 80 bushels of corn per acre, and their methods are worth studying. Great care is taken in the selection of seed grown in that latitude. The ground is plowed deeply, from six to eight inches, and disked carefully until the soil is pulverized to the fine, mellow surface needed to conserve moisture. If the ground is rough or soddy a harrow must be used. Plant to a depth of three or four inches, first marking with a common corn row marker, using for the planting a one-horse corn drill having an attach-

ment which can be operated by the driver. Harrow twice, cultivating both ways. Several cultivations must follow this, the first one being very deep, the second time not quite so deep, with the third quite shallow and farther from the corn. Later cultivating is shallow and only to prevent the formation of a crust on the surface through which moisture escapes. After the corn has been stacked or shocked and wild grass has grown turn sheep into the field. They do no serious harm to the corn and will eat the weeds and wild grass very close.

A one horse tool is best for large corn plants, and frequent surface cultivation with this during the silking and tasseling period is as imperative for a perfect harvest as is deep cultivation earlier.

One bushel of seed corn will plant from five to eight acres. If you use "scrub" corn for planting you will probably get about one-fifth as much return in ears to every 100 stalks as you will with "pedigreed" corn.

Why Does Popcorn Pop?

Why is it that popcorn pops better than a variety of field corn? Corn contains in its core, or center part, a trace of volatile oil and some water. Heat causes this oil to expand in a gaseous form. The outer coating of the kernel is tough enough to bear the process of the expanding oil for a moment, until it suddenly bursts, turning the partly cooked kernel of corn inside out.

The reasons that ordinary field corn does not pop so well as that variety of corn known as popcorn, are as follows: First, the popcorn variety contains more of the volatile oil; second, its outer coat or crust is tougher and will bear more pressure before it bursts; third, ordinary field corn is porous. The outer coating has many minute cracks and openings that allow the volatile oil to escape without bursting the kernel; fourth, the popcorn kernel being much smaller than the ordinary kernel, it is better cooked by the same amount of heat, and in popping open its contents are fluffy and tender, whereas, the ordinary corn being imperfectly cooked does not behave so well. However, the ordinary corn of the yellow variety will often pop out quite satisfactorily, but is greatly inferior to the regular popcorn.

Popcorn is not a very easily digested food, but with ordinary good digestion constitutes a very toothsome and wholesome tidbit. It was the staple food of our predecessors, the American Indians. Given a few handfuls of parched corn and a little jerk of venison, he was able to endure many days of weary march and fatigue.

The Oat Field.

Not enough attention is given to the oat crop. Especially is this true in the matter of fanning seed oats to secure good seed and in the selection of the best soil for sowing the seed. Oats will grow on a wide range of soil, but a clayey loam which is well drained is the very best. Plow this in the fall if possible, disk harrow both ways, and follow with several harrowings with the disk harrow. Last year's corn land makes a good spot for oats, granted that it has been as heavily fertilized with manure as corn land should be.

If the plowing must be done in spring, get about this as early as the soil can be worked. A field green cropped for winter makes excellent oat land for spring. If barnyard manures are put on oat land in the spring they must be well rotted and harrowed in rather than plowed. If commercial fertilizers are needed, 200 lbs. of nitrate of soda per acre, sowed broadcast a month after the seed has been planted will greatly increase yields, if the soil is in good state.

Some of the best varieties of spring oats, as tested at experiment stations, have been found to be Silvermine, Texas Rust Proof and New White Sensation. These each yielded over twenty-five bushels per acre. Early sowing is most important for any variety, as the later the sowing the poorer the yield. Oats need the cool of the spring, and the crop should be all in by a week after the soil can be worked. From two to three bushels of seed per acre are needed, according to the capacity of the soil. Drill the seed in about an inch deep.

The value of oats as a forage crop or for haying purposes will be greatly increased by sowing one-half bushel peas per acre to two bushels of oats. This combination ranks with corn well and has the advantage of a much earlier harvest. Cut oats for a fodder crop when the tops are just getting brown. At that stage stock will eat tops and straw clean, as the early cutting retains the sap in the sheaves.

Rye In Minnesota.

Bulletin No. 120, of the Minnesota Experiment Station, gives much attention to "Rye Growing in Minnesota,"—a state where the yield per acre of rye is larger than that of other states. Although the acreage of land given to rye growing is smaller than in any other state. The dry, sandy loam of Minnesota furnishes an ideal soil for rye culture, which is at its worst on wet, heavy land.

The seed bed must be well prepared by the middle of September for poor soil. On ordinarily fertile lands, the last of September will do for sowing. If your area is very rich the early part of October will be the best time. Allow some variations in this for climates where early cold weather sets in by November. The rye plants must be of a good height before that season, and therefore on light, poor soils early fall seeding is needed. About one bushel of seed per acre is a good allowance for such soils. An average field will need about one and one-half bushels, but a rich soil can take good care of two bushels per acre.

Plow the ground early in September, unless it has been so treated during the previous season that the soil is open and tolerably fine. In that case a few good harrowings will get the earth in condition for seeding. Rotted stable manure broadcasted before harrowing will be the best fertilizer. Rye yields often 30 bushels per acre, but the average yield is not half that amount.

Fall sown wheat and rye make the best early green food for the stock. Two plantings of each of these in the fall, one about the first of September and another about a month later, sown generously, will

bring a succession of soiling crops early in the spring. Three bushels of seed per acre should be used for this purpose, and the soil made as rich as possible. All kinds of stock take kindly to rye in the spring, but it is apt to give an unpleasant flavor to milk, if dairy cows are fed heavily on it.

Cow-Peas.

The cow-pea, both as a forage crop and a soil improver, is useful. This, though a southern plant, is grown now successfully in northern localities, provided the earliest varieties are planted when the ground is warm. Cow-pea hay contains about ten per cent protein, thus almost equaling wheat bran in that respect. The cow-pea, however, for some varieties, needs about five months of summer weather to mature. Therefore, in the northwest, it is not wise to plant the late maturing varieties, although they make more than the early kind. In the south this pea is often sown broadcast with the growing corn just before the last cultivation. Do not plant, anyway, till the ground is warm for cow-peas "take cold" easily. Sometimes, where clover does not do well, cow-peas make a good substitute as fertilizing agencies, though they do not send out such deep roots, and therefore do not bring up so much potash and phosphorus from the subsoil.

Peas, disked in, and oats or barley sown just before they come up on the same land will make an excellent soiling crop, and if used for that purpose, where wild oats are on the land, they will be ready for cutting before the wild oats are ripe. It would be best to sow oats rather than barley for this purpose. Plow the peas under about four inches and sow oats broadcast, about one bushel each in proportion.

The pea canning industry now furnishes, as a by-product to the factories, pea vines as stock food. Pea-vine hay is considered better than clover hay, and whether hauled away from the factories by the farmers, or made into silage by the factories the hay has become quite valuable in some sections. If pea vines are to be cured for hay they must be spread on sod land. If put up in stacks they must be thoroughly tramped, when decay will not affect the interior of the stack. Where possible pea vines are fed to stock in the fresh state.

Cow-Peas Sown for Live Stock.

Peas and oats sown for live stock ration should be mixed in the seed proportion of about two parts peas to one part of oats, as almost any good prairie land will grow oats more readily than peas. This amount, it must be remembered, will vary with the kind of soil. On a stiff clay soil oats will not lodge so much and the crop can be cut with a binder. A year or two of trial will soon show what proportions to use. If you are growing for young pigs and brood sows, it is possible to let the young pigs do the harvesting for you, after they have become used to the food. Try a few days of cutting and feeding the peas at first. This will be likely to prevent the pigs from any danger of overeating when they are turned in the field, and

they will eat clean as they go—without tramping down the crop. Begin the feeding when the peas are about fit for the table. One acre should be enough for about 20 or 25 pigs if they are only fed during the growing season and for this purpose sow as early in the spring as possible in well harrowed ground. Two bushels to the acre, sown broadcast, and plowed under as deep as five inches, can be put in about two weeks or a little less before the oats are sown. Harrow after oats are sown. For small patches of peas a movable wire fence is good, especially when two crops are planted. This is always advisable, as peas for feeding in this way are best not matured, being of too heating a nature. While feeding peas to young pigs let the pigs have plenty of salt and water and skim milk if possible.

Growing Flax.

The importance of the flax-seed crop in our future industries is becoming more and more an established fact. It is not quite twenty years—in 1895, in fact—since experiments were made in this country in breeding flax. Using the ordinary flax for foundation stock, two classes were bred, one for seed and the other for fiber. Since then new varieties have been grown, which have increased the plant over 50 per cent in height and seed value. As to the crops grown, the Dakotas and Minnesota still hold the banner, North Dakota having reported exceptional yields of as high as thirty-five bushels per acre, with eighteen to twenty bushels per acre several years in succession. These, however, must not be taken as any ground for averages. But they show why the culture of flax is becoming more popular and why so many farmers in the Dakotas, and more in Minnesota, have been going into the sowing of several sections of land to flax raising. From five to sixteen bushels per acre in dry seasons, but thirty bushels in a good season, prove that tillage will do much for this crop. The fact that the only linen factory in the country is now being established at Beloit, Wisconsin, and that it expects to draw upon the flax raising districts of the northwest for the supply of flax to what will become a large industry is strong evidence of how much progress the culture of flax is making.

Many farmers advocate mixing wheat and flax for seed, in the proportion of two parts of wheat and one part flax, five pecks to the acre. Or one bushel of wheat may be put in with the drill, per acre, and cross seeded with twelve to sixteen quarts of flax. Flax should be sowed much more shallow than wheat to secure the best results. The mixture of grains is believed to greatly improve the quality of the wheat, and thus more disease resisting. Barley and flax together are also grown with more or less success. Some of the grass seeds sown with flax as a nurse crop, have given good returns, using about 20 quarts of flax seed per acre. The best yields of flax often come from very early seeding when used with clover and timothy in this way. It is a mistake to sow flax about corn planting time, or later.

For raising a paying crop of flax seed, land should be very rich. A rotation of clover on manure dressed land, then pasture plowed in and flax sown in the following spring after another light top dressing

of manure in the fall, will give good prospects for a commercial flax crop. Do not repeat the flax sowing again until after another rotation of corn, oats and clover. Otherwise the soil will furnish you chiefly flax wilt. Sod land usually makes the best crop of flax. Treat the seed, however, even on broken prairie land, with the formaline solution in order to kill any germs of flax wilt. If these go into the soil with the seed, the new land will be infected and the probable destruction of any future crops of flax on that ground will be the result. A new field sown to flax, however, with no resultant flax wilt, can be sown to other grains in rotation with profit, and then used for flax again, provided good tillage has been observed in the interim. Flax takes about as much from the soil as do corn or wheat. The general testimony as to flax straw for winter feed for cattle seems to be favorable. In a few cases where what seemed to be bad results had followed, careful inquiry has shown that foul weeds or mustard had become mixed with the straw. Stock fed on flax straw must have plenty of water, or the toughness of the straw will cause indigestion. Flax straw grown on old soil or mixed with pigeon grass usually does well as a feed for cattle. However, caution is a good practice in using flax straw for fodder for valuable stock.

Flax matures early, and can follow wheat, oats and barley in the order of sowing in the northwest. Its high price and the evidences that it will remain high make it of more and more value each year.

Millet.

Millet grows best in warm weather, and does better when planted after corn planting, and usually while it is dry, though a low, moist soil is needed, yet not too moist. I have known millet to be sown, in favorable seasons, as late as the end of June. The middle of June is a good time to get in the crop in dry weather. If the crop is intended for dairy cows, sow the German millet in the proportion of about one-half a bushel of seed to the acre if the soil is good. More seed will be needed on poorer soil, or for sheep fodder. Millet should never be fed as the only food.

Cut millet for cattle and sheep when some of the heads are beginning to ripen. For horses Hungarian millet is said to be better, and this should be cut two or three days later than that for cows. Millet should be cured as clover hay is, in the winrow, so that the bright green color of the hay will be presered. Hog millet is fine as a food for hogs. Siberian millet is an excellent variety, and grows under favorable conditions, to the height of four feet.

Sow the seed broadcast on a fertile and well prepared soil about the middle of June. Harrow very lightly, and by the middle of September the seed will be ripe. Do not allow any variety of millet to get too ripe before cutting if it is intended for cow feed or for sheep. For pigs, let the grain mature.

In feeding millet, a proportion of one-third millet and two-thirds bran or ground oats is best for milch cows. Never put much corn with millet as the two grains are very much alike in their constituents. What is called hog millet takes just about the same amount

An unusually large stand of wheat at Lake Minnetonka, Minnesota.

of fertility from land in cropping, as does corn, but corn always has, as a soil agency, the advantage of the extra cultivation that the land receives.

Good varieties of millet may also be found in the German and Japanese. At the Virginia experiment station recently, Hungarian millet yielded 3.85 tons per acre, while the German and Japanese returned respectively, 2.80 and 2.42 tons per acre.

Buckwheat.

In a northwestern climate buckwheat must be sown in June, but in milder latitudes sowing in early July will insure a harvest before the fall grains are sown. Buckwheat is tender to frost, and needs, at least, two and a half months to mature. It does not demand a very rich soil, which is doubtless the reason why yields are reported in the same locality of such varying amounts—from 15 to 40 bushels.

For the best fertilizer to add to a poor field where buckwheat is to be sown, unleached wood ashes, twenty to twenty-five bushels to the acre, broadcasted, will add the lime and potash plant food that this grain needs for heavy yields. On such a prepared soil it will pay to broadcast and well harrow in three pecks per acre of seed. It takes some weeks for the ripening of grain; for heavy yields, however, it is best to cut soon after the first seeds have ripened.

A half bushel of seed per acre will do on the average soil, for June sowing. In this, though, as in every other grain, it costs as much to seed, grow and harvest a thin crop as a fat one. Therefore try the fertilizing and heavy seeding. Late seedings of buckwheat do best when sowed with a drill.

Barley.

Barley, which costs somewhat less than oats, is not so satisfactory a ration for constantly working horses as is oats. Barley should be fed whole, and will do very well for horses only at a moderate amount of labor. The best barley demands a special kind of sandy loam soil with some clay, and a practically rainless climate, at least during the harvest season. If grown on a soil similar to that of Minnesota, it can be harvested as a fairly good barley for malting purposes, by cutting at that first point of ripeness where it is not yet quite ripe, and a little of the green shade mixes with the yellow in the heads. Shock as soon as cut, in shocks long enough to admit of two sheaves, meeting in the center at the butt ends of the sheaves, being spread out over the shock below. These two cap sheaves, if spread out well at the side, and left to hang over a little at the ends will protect from both dews and too hot suns. These cap sheaves should not be mixed with the others when the shock is drawn, as the heads will be too brown for market prices.

Barley and rape mixed in proportions of one bushel of barley and three pounds of rape seed to the acre make an excellent pig pasture if pigs are turned into it when the crop is well started, and the rape is young. A second tender growth can be had later on, when the rape grows too strong, by mowing a part of the field. The barley that is not eaten will also often seed again and come up in early fall

for a second pasture. Sow plenty in the spring and you can then cut back, thus insuring plenty of pasture even in a dry season.

Barley and oats make an especially good early swine pasture on brush land broken in the fall.

Speltz.

Speltz (emmer), which is a species of wheat in the chaff, is a good yielder and stands dry weather well. The stock like it and thrive on it, and it is especially good for growing animals. Equal parts of speltz, oats and barley ground and fed together make an excellent feeding ration with about five per cent of flax seed added before grinding. Some clover hay once a day and a few ears of corn are necessary at each feeding. In sowing speltz seed it should be remembered that the hulled seed does not germinate so readily as the unhulled. On good soil—a black loam with clay subsoil—two bushels of speltz seed to the acre should give a full yield of good grain from forty to fifty bushels. Mix with oats and a little barley. It matures in about the same time as oats, and makes a good stand, not being molested by chinch bugs. Speltz will grow fairly well on light soils, but yields often forty bushels per acre and occasionally from fifty to sixty on rich and thoroughly cultivated land.

Sorghum Raising.

The question of raising sorghum for cattle is one that has been much discussed of late years. There is no doubt but that for fall feeding—from September first until hard freezing sets in—sorghum is greatly liked by cattle. They eat it up clean, and I have found it better than corn fodder at that time. But to grow sorghum successfully requires a very thoroughly prepared soil. Given this, and the right cultivation by a judicious use of the harrow after the seed has been sown—taking care not to kill the plants by too late harrowing—fine crops of sorghum can be raised.

The Wisconsin Experiment Station says, recently, that no crop which it has grown has furnished "as much food to the acre for dairy cows as sorghum, and no crop had given more satisfaction while it was being fed."

Prepare the land for sorghum in the fall previously, and work it over several times on the surface in the spring in order to help to clean the seed-bed. When growing for dairy food put it in with a grain drill, and sow from one to one and one-half bushels per acre. Cut with a mower and throw up in small piles within two or three days after cutting. Leave in shock till cured and then stock under cover. If the sorghum is planted in rows like corn, a common corn binder can be used in cutting.

Sorghum may be fed after freezing, but if frozen too hard it is not so good for feeding. If thawed it loses some of its food values. Cut the plants at any time desired for hay from the time they come into bloom until the seed is in the dough stage. The Minnesota amber variety is a good one for the north, but there are several excellent sorts. The second growth of sugar-cane is apt to be poisonous to cattle, or if stunted by dry weather unfavorable results from feeding

may follow. Sorphum is quite likely to sour in a silo, though there are farmers who are able to use it for ensilage.

Sorghum has many points of profit in its favor as a fodder. Its yield is large, its flavor is much relished by cattle and horses, it grows in dry weather better than corn, there is no waste in its use and any climate where there is not more than three months of frost will grow the plant.

The objections to its culture are the expense of seed and the heavy nature of the plant as to handling in harvest time. It also needs close attention in the early growing season. An acre of sorghum requires from fifty to eighty pounds of seed, which can be put in with the grain drill. One acre will furnish enough fodder for a large amount of stock. Home grown seed is much more reliable as to results than that on the market. This can be secured from well ripened cane placed in shocks to cure, and the tops not separated from the stalks until cold weather. The seed can be easily threshed out and cleaned then and stored in dry boxes or barrels where it will not heat.

Wheat Raising.

Raising wheat is a good business when the yield is from 30 to 40 bushels per acre. That this can be realized, under proper conditions of fertility, is shown again and again by the many instances of accidental good harvests from plots of land specially fertilized. I knew a farmer in one of the Dakotas who harvested from 98 acres of a 100-acre piece of wheat a yield of only eight bushels per acre. From the other two acres he threshed 80 bushels. The two acres had been hog pasture, and had been plowed and tilled in the previous fall. The 98 acres had been sowed to wheat for four successive years with no manuring.

In those four years of only growing wheat the farmer had been robbing his land every year of about $300 worth of fertility, granted that the eight bushel per acre yield had been uniform through the four years. This statement is based upon figures from agricultural stations showing that:

"Fifty bushels of wheat in the grain contains twelve pounds of phosphorus, valued at $1.44. The straw, 2½ tons, contains four pounds of phosphorus, valued at 48 cents. In addition the wheat crop contains $14.40 worth of nitrogen and $2.88 worth of potassium, or a total of $19.20 worth of fertility taken from the soil. These elements are taken in varying quantities. If the grain is fed to animals, one-quarter of the phosphorus which it contains is, on the average, sold in the animal product. If these products are butter and cream, a thousand pounds would contain only about 30 cents worth of nitrogen, potash and phosphoric acid. The skim milk from which this butter came would contain about $8 worth of nitrogen, 84 cents worth of phosphorus, and 72 cents worth of potash. In the case of wheat, practically none of the grain is fed to stock, and under present conditions the farmer buys back very little of the bran and shorts, which contain large quantities of nitrogen and phosphoric acid.

"It is to the interest of the agriculture of the state as well as to

the millers and the railroads that the price of these by-products and the transportation rates for them should be so adjusted that they will remain in the state. In addition to the sale of shorts, bran and other grain by-products, we are shipping to Europe large quantities of phosphates from our phosphate mines. Hopkins truly says that we are selling for the paltry sum of five million dollars what will be worth a billion dollars to the next generation. We cannot emphasize too strongly the importance of conserving our phosphate supplies for our own soils, which are in many cases quite deficient in this element. We must soon follow the practice of European farmers and add more of this element to our soils than we take out in crops."

From 8 to 20 bushels per acre of No. 2 wheat is considered an average yield now in farming, since more modern methods of crop rotation prevail. But the idea of heavy fertilizing on wheat lands is still far from a prevalent one. Fifty bushels of No. 1 wheat per acre might be raised by 50 loads of well rotted manure to the acre, and this would mean smaller farms but more systematic and easier managed farming. Forty acres sowed to wheat would return more than 150 acres under the old style, and when the season was over there would still be stored up fertility for other crops. Clover the wheat then and turn the stock into it—all but dairy cattle—which should not feed on new seed clover alone. Save all of the straw from the wheat field, and bed the stock plentifully with it. Apply this long manure to the clover field—20 or 25 loads to the acre, plow it under and plant corn the next year. The next crop may be wheat again, with clover and timothy sowed with it; or oats and barley may be seeded early in the spring with the Mammoth red clover and timothy. By this way of farming two crops of the best clover hay may be cut in one summer, and a corresponding increase of stock be put upon the farm to increase the fertilizing agencies for another season. But the wheat farmer of today must also know how to be as scientific in breeding his grain as he is in breeding his stock. The improved varieties of field crops of today have become improved through two very opposite influences; heredity and variation. The wise farmer for the tomorrow of farming in this country is the one who knows that he must strike the balance between these two agencies by the most careful environment if he wants the scales to tip toward an improved variation and remain there. By scientific selection and training the No. 1 Minnesota has been developed, but if continual inbreeding, selection and cultivation did not maintain this wheat to its level, No. 1 Minnesota would quickly drop to standard. The seed of No. 1 wheat is by no means all No. 1.

Rust Resistance.

However, the northwestern and, in fact, all the wheat growing states, have made marked progress in this direction of scientific wheat growing in the past six years. In the one feature of rust-resistance in wheat much has been accomplished. Less than a decade ago the alarm over the prevalence of rust in our grain fields led to rapid and close attention in our agricultural colleges to the development of a

wheat that could turn aside the rust disease. In this they have so far been moderately successful, and still better results will follow. In a recent address Dean Woods, of the Minnesota State Agricultural College, said: "Ultimately we will have a rust-resistant variety of blue stem wheat secured by combining by hybridization the rust-resistant quality of the durum wheat with the berry of the blue stem. From the work already done, it appears that this may ultimately be accomplished."

There is no other known cure for rust, except to breed rust resisting varieties of both wheat and oats. Weather conditions develop rust, but the character of the stand of grain makes considerable difference in the seriousness with which rust will attack it. It is almost certain that the spores of the black rust usually live over winter on the straw of the wheat plant.

Seed Grain.

The old idea that new seed should be got from some distant place for wheat culture each year, because wheat grown on the same farm year after year would degenerate, is fast vanishing. Every farmer should set aside a separate plot of his most fertile area, and sow it each year to wheat, or any other grain desired, with the purpose of raising his own seed grain.

In buying, a new variety of seed from a colder climate or higher altitude is desirable. Wheat grown farther south and in a warmer climate will usually not mature, but will need a longer season, while if the seed comes from farther north it will always come earlier and be ready to harvest sooner and will be of better quality. Seed wheat growers should use formaldehyde, in any case. A solution of 1 lb. of this in 40 gallons of water should be sprinkled on the wheat, in quantity sufficient to moisten it. Either shovel over until dry, or sow while still wet, opening the seeder to sow several quarts per acre more of the swollen seed. These directions are given by the Minnesota Experiment Station, and the process costs a few cents per acre.

On this seed area, if good wheat is wanted in return for the season's labors and expense, well cleaned seed must be sown. Where one hundred bushels of seed are needed, take one hundred and seventy bushels of wheat and clean them again and again until you have the one hundred bushels of good plump seed demanded that every seed shall mean a vigorous plant. For a less area, take in proportion. If the ground is strong and rich in plant food stiff-strawed wheat should be sown and generally such a variety needs a little heavier or thicker planting, as it will not stool so well.

Well-matured seed, however, does not, of necessity, mean the largest seed, although only well-matured, cleaned and even, sample-like seed should be used—free from noxious seeds and, if possible, grown expressly for sowing purposes. Any farmer who can establish a reputation for growing such seed grain of superior value, especially of the new varieties that are above the average in yield or quality, can command a high price for such grain, not only among his neighbors, but in the market.

"The total yield of a field of grain depends not only upon the quality of each plant, but upon its ability to multiply in a numerical ratio," says a trained agriculturist. Try, in any season, good or poor, the experiment of sowing the average seed and the best seed, on different plots of your land; give these plots exactly the same treatment as to tillage, and harvesting, and see if the difference in yield does not prove the commercial wisdom of the purchase of the best seed. If the season is unfavorable, the plants from good seed have a resisting power that will count much in the last of the season; while the "average seed" will be grown at a decided loss. If the season is favorable a difference of several bushels per acre will result. To quote from J. J. Hill's address to the graduate students of the Minnesota State Agricultural College in 1909: "The yield of wheat in Minnesota in 1908 averaged 12.8 bushels per acre, from soil once as rich as any in the world. I will not compare this with the yield of other countries, nor with states like Washington and Oregon, where they raise an average of 23 or 24 bushels to the acre, though that would not be unfair, but with the average of the whole United States, slovenly and wasteful as its agriculture is. The average yield of the acreage sown to spring wheat in this country in 1908 was 13.2 bushels per acre. With our natural advantages we might easily have doubled that. We might certainly have equalled the average of 15.5 obtained in Iowa or the 17.5 in Wisconsin. If we had, it would have put many millions in our pockets. But if we had raised the average in Minnesota even the little four-tenths of a bushel necessary to lift it to the low national level, it would have added over $2,000,000 to the wealth of the state. If we had done as well as our neighbor state on the east, we should have been gainers by over $20,000,000.

"The average for oats in Minnesota last year was 22 bushels, and in the United States 25 bushels. Wisconsin produced 31.1 bushels, more than 40 per cent above us. Again the difference between the national average and that of this state represented a cash value of nearly three and a half million dollars. In few other states do potatoes grow in such abundance and of so fine quality. The average product per acre in the nation, about what other countries would consider a partial crop failure, was 85.7 bushels last year. Minnesota's average was 76 bushels. The difference amounts to more than three-quarters of a million dollars. Taking these three crops only, with whose care our farmers are well acquainted and which respond readily to ordinary cultivation, and having as a standard the small average of the country as a whole, Minnesota's loss in 1908 was over six and a quarter million dollars. If comparison were made with what might have been done by the best farm methods, the figures would almost pass belief. A dollar lost by neglect is lost just as much as if it were taken away by force. Yet were anyone to propose a tax of six or seven million dollars annually on the farmers of the state it would rightly provoke them to fierce resistance."

As a last argument let me say that a recent report from the Nebraska Experiment Station says the difference in yield there between

heavy seed wheat and the "average seed" was 6.5 bushels per acre. Blow away your shriveled seed! Don't sow it again.

The Soil.

Wheat needs a fertile soil of well drained clay loam for its best returns. But lighter soils, if made fertile and highly tilled, will give large yields. The best fertilizer is well rotted stable manure broadcasted either before or after plowing. If strawy or coarse manure is used, it should be on the crop preceding the wheat. For a commercial fertilizer, any good one compounded of nitrogen and phosphoric acid will be best, as wheat takes large quantities of both from the soil.

In cold climates fall plowing is always advised for wheat. The soil is frost-bound all winter, and this freezing aids greatly in breaking up the hard lumps of earth thrown up by the plow, and thus pulverizing the soil for the harrowing to follow. If fall plowing, in some seasons, seems to make the ground too hard, apply the disking process. Whatever the process is, the soil for wheat raising must be in good, well fined condition for early sowing in spring with three or four inches of pulverized earth on top. On very light soils rolling may be done before and after seeding.

From one to one and a half bushels of seed per acre will be needed, according to the soil fertility and the time of sowing. For early sowing of winter wheat not quite so much seed will be needed, even on rich land, as the plantlets will be stooled before cold weather. For late seeding add a couple of pecks more per acre. If the seed is broadcasted, however, and not drilled in, two bushels per acre may be needed. If any aid to yield is needed in the spring, nitrate of soda (200 pounds per acre) can be used.

Wheat should be cut as soon as the straw has turned yellow. Never leave it until it is dead ripe, as such wheat has too much bran. For a thin bran harvest, cut early.

In the rainy seasons that are apt to come in September in some parts of the Northwest, it is often wise to cut all the small grains a little early. Such grain will cure in the bundle or shock fully as well as upon the root. Cutting on the green side of the ripe stage, anyway, is always better than on the over-ripe side. Large crops per acre can also be harvested with more speed, because the harvester is cutting more bushels which is another argument for enriching the soil. Have plenty of binders, and keep them all in good condition for work, by saving and protecting the older machines.

Seeding To Winter Grain in the Northwest.

All this seeding should be done in the first of September, so as to give the grain two months of growing weather before hard freezing sets in.

If the seed bed was well prepared the grain will make a strong growth and make a good, vigorous start in the spring. Also the blades will mat down over the roots and furnish a lodging place for the snow and prevent it from blowing off, thus ensuring a good winter covering.

Early sown grain stools or produces a number of branches from

one seed that bear heads of grain. Late sown grain, on the other hand, never stools very much, and consequently reduces the total crop, thus making early sown grain the most profitable.

The Hessian Fly.

The Minnesota Experiment Station has issued a bulletin (No. 84) giving the following directions for fighting the Hessian fly:

"1. Burn the stubble when, from any reason, shallow plowing is unavoidable, or when plowing is to be delayed in the spring until after emergence of flies. If the stubble is left long it will burn easier. Some farmers are willing to go to the trouble of spreading straw from thrashing over the stubble, thus insuring the burning and at the same time getting rid of some 'flax seeds' which may have lodged on the surface of the straw pile at the time of threshing. It is well, however, to remember that repeated burnings, from the standpoint of our chemists, are not good for the soil.

"2. Fall plowing of the stubble in such a way that the straw is completely turned under. In this connection we should not overlook the fact, made evident from the findings of 1903, that volunteer wheat, wherever found in the fall, may contain 'flax seed.'

"3. All screenings and litter about the threshing machine should be cleaned up and either fed immediately or burned, leaving no litter from the threshing on the field. There is no absolute need of burning the straw pile. The flies emerging from 'flax seeds' in the center of the pile will never reach the surface.

"4. Since the fly lays its eggs as a rule near the locality where it emerges from the 'flax seed,' it is best not to plant wheat on the same ground two years in succession where rotation is possible. Varieties of wheat that produce a stout stalk are the least affected by this pest, and varieties of wheat should be selected and the soil handled to that end, remembering that a rank growth does not mean strong straw, but the contrary.

"5. Co-operation is absolutely necessary, for, however careful one man may be, if his neighbor is not equally so the latter's fields will afford a supply of this pest for the former. Since this pest issues from the 'flax seed' early in May, a stubble field left for corn land and not plowed up to the 10th of May or later has probably discharged its quota of flies, ready for mischief, before plowing."

Miscellaneous.

For rotation of crops a farm should be divided into at least four fields, and fenced around each field. A few acres of clover enclosed with woven wire fence are needed for pigs and sheep, if the farm is chiefly a stock farm. By this method of fencing the after-feed can be utilized by stock to great profit and economy. A fence made of two barb wires, with posts grown on the farmer's own woodlot, set a couple of rods apart will cost about twenty cents per rod, or perhaps a little more. Ordinary stock will be turned by such a fence. A good staple puller for fences that need repair can be made from the head of an old monkey wrench, heated at the blacksmith shop and forged into a slightly hooked point, making it small enough to enter the staple. Strike this with the hammer until the staple starts.

Quack-Grass.

The best way to kill out quack grass in large fields is to destroy it by the cultivation of some other plant. Corn and potatoes grown on quack-grass sod are most effective for this purpose. After harvesting the season's crops plough up the quack-grass sod in the fall. Be sure to turn all the grass under and then drag the same way it was ploughed. In the winter put on a heavy coat of barnyard manure. Plant this ground to corn or potatoes the following spring, cultivate well, plough and drag again in the fall. Repeat this process two years at least, three years are better, if you want to get a sure result. Frost and sun are sure death to quack-grass roots.

After raising these three crops of corn or potatoes sow wheat, oats or barley—with eight quarts of medium red clover seed to the acre. Harvest one crop of grain and then a second crop of clover. The next season use for pasture. The next, after more manuring in the previous fall, plow for corn or potatoes again. Quack-grass will be as scarce as hen's teeth by that time. Never allow quack-grass to get ripe. Cut it in full blossom. One acre will seed a large farm.

At the Minnesota Experiment Station small spots of quack-grass are killed out by smothering with tar paper. Mow the quack-grass first and then remove it. Cover the spots completely with tar paper, lapping this several inches and binding the seams by a few shovels of dirt. This method kills the grass in about two months, and the paper can then be taken up and used in other places.

For quack-grass around trees, telephone posts, etc., I have found heavy applications of coal ashes good. Scatter these about six inches from the base of the tree and circle out about eighteen inches in width. Hand digging for small spots is usually effective where crops like potatoes or corn are cultivated.

To destroy foul weeds the best way is to summer fallow and plant corn the following year. For wild oats, plow immediately after harvest, making shallow furrows. Plow in spring very deep and immediately sow to barley, which will mature before the oats grow. Harvest this shallow plow and sow another crop of barley. Some farmers sow to fall rye, following by barley next year, and then corn. Hand pulling for what spears of wild oats remain is then practiced. Canada thistles are best eradicated by marking off the thistle patch to itself, and carefully keeping that spot separate from any seeding operations. Then plow, and keep on plowing every time the thistle plant appears. Fortunately the thistle has nearly disappeared from the country, owing to the more thorough cultivation farm lands have been getting of late by rotation of crops.

For a home-made cart to attach to the farm harrow, buy a second hand road cart, or a new one which will not cost more than a dozen of dollars, and attach it to the evener. This will bring the wheels up pretty close to the harrow where you can ride on a good comfortable seat on wheels that are high enough to be easy and thus the horses will save the man. The thinking man can introduce a large number of these labor saving devices on the farm, which will help make farming a pleasure instead of a burden.

CHAPTER X

Small Fruit Raising

THE writer has had a large practice and training in growing all kinds of small fruit, and has found that fruit-raising near large bodies of water is likely to be more certain as to results. I know this by my own experience in Western New York. There is more moisture and less frost in spring and fall; and near the Great Lakes, especially, more rainfall. Most of the fruit of Michigan is produced in orchards near Lake Michigan. The grape belt of New York lies in the proximity of Lake Erie and Cayuga Lake. The same thing is noticed in Minnesota, where the abundance of lakes, large and small, furnishes an excellent opportunity for fruit growing.

For small fruits, as well as for gardens, a soil where a light, sandy loam predominates is best. This is especially good at harvesting time, as after rains it dries off quickly. A clay loam, with clay subsoil, is good for raspberries. If you can, it is well with sandy soil to add some good black dirt to the sand. A covering of from four to six inches of this soil with the same proportion of well rotted stable manure ploughed in thoroughly before covering, will insure you a good garden, whether for fruit or vegetables.

Raspberries.

Yet even in alkali soil farmers have made a success of raspberry raising by freely manuring. I have even seen raspberries raised on the open prairie, without any wind break, by well covering with old hay and straw. In the spring the hay was tramped into the ground and if this was not sufficient, to smother the weeds, the farmer put on straw enough to cover the ground all over. This acted as a mulch in dry weather, and in wet weather kept the berries clean.

Generally speaking, however, the best way to raise raspberries for the home or market is to plant in the spring, if possible, six feet each way, and cultivate lightly both ways with horses. This does away with the backaching hand work. The berries are larger and sweeter because they get more sun when grown in hills six feet apart. They are also brighter colored and more even in size, bringing higher prices than those grown in thick rows. No sun can shine on these last, and in wet weather they amount to nothing. Red raspberries and blackberries may safely be set in the fall if the canes are cut to the ground.

Prepare the ground thoroughly by deep plowing, as it will be almost impossible to do anything but surface cultivation after the plants are set, on account of the lack of deep roots with bush fruits. Harrow well and then go over the ground marking off rows six feet apart. Short rows are best as they take less time in picking, where much labor must be hired. Row north or south, or east and west,

according to the direction of your strongest winds. If you set six feet apart, about 1,200 plants will be needed for an acre. If you still stick to hand cultivation, and many raspberry growers adhere to the three-foot apart space in the row, twenty-four hundred and twenty plants will be needed for an acre.

Let one person go along the row making the holes for the plants, and another follow with a pail of water holding as many plants as it will. Never expose the roots to the air. In setting plants, spread the fine roots as much as possible, but do not cover the crown deeper than from two to three inches or the plant may die. Firm the earth well around the roots, and then cultivate at least every ten days, once a week is better. From early spring to late August cultivation must go on, and an excellent way to insure such cultivation is to plant hoed crops between the plants. One woman raspberry grower on a large scale, sold enough early peas and turnips the first year from her plantation to pay for the berry plants. If, on the other hand, the soil is light and needs humus a cover crop can be sown between the rows in August.

But raspberries, especially red raspberries, do not require a very rich soil. Tillage, and the annual mulch of well rotted manure, will keep the soil in good shape if it is only deep and well drained to start with. Blackcap raspberries can stand a richer soil, and more frequent fertilizing. Blackcaps have been known, with high culture, to yield 10,000 quarts per acre.

Where blackcap raspberries grow on cultivated ground, the rows need to be six feet apart and at least four feet in the row. Mulch these every fall also. Protect them on the north. Set out new rows and plow up the old ones after five or six years. Cut out all the old dead wood in the spring and again after picking in August or by September 10, and cut the new canes back about 30 inches. I never turn down the canes or cover them, but if one wishes to do this for winter covering loosen the dirt around the roots with a fork-spade, when the bushes will then bend down without breaking the young canes.

Care the First Summer.

"The Garden and Farm Almanac" says that "The first season is a very critical time in the growth of the small fruit garden. Do not neglect it. The most important thing to look after is the tillage. Use the cultivator and hoe frequently and thoroughly. Keep the entire surface of the garden stirred, not simply to kill the weeds, but more particularly to make a mulch of dry soil which will keep the soil water from escaping by evaporation. A mulch of straw may sometimes be desirable in later years, but the first year the mulch should be made of well-tilled soil. Be especially careful to stir the soil after a heavy rain when a crust has formed. Whenever you find the surface soil crusted, you may know that much valuable moisture is escaping; break it up with the cultivator. On very small areas a stirring of the surface with an iron rake, every three or four days, will keep up the best kind of a mulch and the

weeds cannot grow. Be particularly attentive to the strawberry bed. Allow no weeds to get a start there the first season; then it will not be difficult to keep down the weeds during subsequent seasons. Tillage should not be kept up much after the middle of August, as it will cause the plants to grow late, and so be more liable to winter killing. Let the weeds grow in the fall as they will; they protect the soil during the winter.

"When the raspberry and blackberry shoots are a foot and a half high, pinch off the ends, so as to get branched canes. Look out for currant worms. When the first worms appear, others are almost sure to follow. Pick them off. Spray the leaves with hellebore—one ounce in three gallons of water. Usually it will not be necessary to stake or trellis the brambles the first season.

"If you desire to increase your planting of raspberries another year 'tip' some of your plants. When the canes bend down, and long whitish ends appear, cover these firmly in the ground three or four inches deep. In the spring the tips will have rooted and can be cut off and transplanted."

All work of cultivation should be done before blooming. The ground must be well covered with a litter of hay or straw before that time also. After the fruit is picked, cultivate again and mulch heavily with barnyard manure well mixed with straw, both for winter protection and to enrich the soil for the next year. In very dry weather it may be necessary to cultivate deep and in such seasons it may be better to cultivate between blooming and ripening, in order that the soil may retain its moisture. But hand cultivation will be best. Keep the soil between free from weeds and grass. Do not use shavings or sawdust for mulching. Remove the winter covering in the spring at two different times. If the spring is warm and early take off a portion in March, the rest in April. The difficulty of any deep cultivation near raspberry roots is caused by the surface growth of the roots—for this reason mulching is very beneficial.

Another Method of Planting and Caring for Black Raspberries and Red Raspberries.

They should be planted seven feet apart and six or seven feet in the row. As soon as they are planted in gardens or fields there should be a flat trellis built over them. It should be two by two and one-half feet high and three feet in width. The posts should be driven in the ground eighteen inches deep. The trellises can be made of wire or slats two inches in width. They should be four inches apart, so as to give the young sprouts or canes plenty of room to come through the trellises and bend over. Cut all of the old canes as soon as the berries are ripe and gathered, for the canes that produced the present season's crop are of no further use after the berries have all been gathered, and should be cut out of the clumps at the surface of the ground. Cut back the young canes about six inches, the middle of August, and leave them on the trellises to winter. When the weather becomes cold and freezing, cover them with straw or coarse horse stable littering, or hay. In

Strawberry-Raspberry propagated at State Experimental Farm, Minnesota. The bush resembles the raspberry and the fruit tastes like a strawberry.

the spring this covering should be put around the roots of the raspberries for mulching. They should be kept heavily mulched the year around. In the spring, as the ground will permit, work the soil mellow.

Another and more thorough method for covering raspberries with earth is to loosen the soil on one side of each bush with a spading fork. Then set the spading fork firmly in the ground on the other side of the bush and push over toward the soil with the top of the fork. This rolls the roots over and avoids breaking the stalks. Then hold the branches down by the fork, pushed into the earth over them, and shovel the dirt on. A deep covering of dirt is not necessary, but enough is needed to provide against the washing of late fall rains, as these may remove enough soil to expose some of the main stem.

Heeling In.

When raspberry plants are two years old, leave on the largest and strongest looking sprouts without pruning until quite late in the fall. By these I mean those that start between the rows after the fruit is gathered. Before frost comes dig these out, select all that have a T root and "heel them in." "Heeling in" means digging a deep trench between the rows and packing in these plants closely, leaving only an inch or two of the cane above ground. This gives you plants to replace others or to sell. Prunings of new wood may also be set out for cuttings. These should be set immediately after cutting, and be about 6 inches long. Set in rows wide enough for cultivating, six inches apart. Firm the soil well and cover well with leaves and litter before winter sets in.

Raspberries are a very perishable crop and must be handled rapidly in marketing. If grown in a large way where other fruit crops are grown in order to not to put all your profits in one crop—they may be a valuable asset in the year's business. Too much rain at the last or too much sun at the beginning of the season, are bad for raspberry results. So much depends upon the weather with this fruit that its growers must not reckon on it too certainly. Raspberries are also subject to two or three bad diseases that are difficult to master completely.

Blackberries.

Blackberries are planted and cultivated the same as raspberries. They need a richer soil, and plants should be set 8 feet apart each way, requiring 680 plants to the acre. This gives excellent chance for the cultivation this bush fruit needs, and makes harvesting the berries much easier. They can, however, be planted as hedge rows with plants 4 feet apart in 8 foot rows. This method requires 1,361 plants to the acre. Some fruit will mature the first year after planting, but a full crop does not come until the third season. A well managed blackberry plantation will bear well for twenty years, but for the best results renew the area about every 8 years. An average yield is about 3,000 quarts to the acre. Heavy fertilizing and high pressure cultivation, however, in favorable years, it is reported, have yielded 8,000

quarts on some plantations. Good varieties of blackberries are Agawam and Snyder.

Prune the blackberry canes back to fifteen inch stubs where the laterals have grown before the berries begin to ripen. About five new shoots to the hill are sufficient, cut out the rest, and later on, after harvest, remove all the canes that bore. Remember that many varieties of blackberries turn black several days before they mature fully and in order to get the richest flavor from the fruit it is necessary to leave the berries on the bush until they come off easily. For transportation this may not be always advisable but it certainly is in the home garden.

In South Dakota the dewberry, a species of trailing blackberry, is said to produce a fruit that equals the bush blackberry if properly cultivated, protected through the winter and trained on trellises.

Strawberry Culture.

The difficulties in strawberry growing are not so many as with raspberries. The yield is heavier and the cost of growing as compared to yield is smaller. Strawberries are more generally in demand for all tastes, and they are less likely to be attacked by disease. They are what might be called a profitable venture for beginners and furnish an occupation in the growing that is likely to be agreeable. Still there is a great deal to be learned yet as to strawberry raising, although it has been said that any one can grow strawberries who can grow corn or garden vegetables.

As to soil, strawberries can be grown in any soil that is not naturally heavy and wet. Soil that has a sandy clay loam is preferable to all other kinds. One of the most essential things in strawberry culture is a deep, rich bed. Select well drained soil and work it very finely by spading or plowing at least six or seven inches deep. Then work in a large amount of well rotted stable manure. Plow or spade this into the soil and work the bed until it is fine and mellow. Air-slacked lime is an excellent fertilizer, when spaded into the soil with the barn-yard manure.

From one hundred to one hundred and fifty pounds of lime is sufficient for a bed twenty-four (24) feet square if well worked into the soil. If the ground is dry and the weather warm, the bed should be well watered twenty-four hours before the planting.

Varieties.

In selecting varieties care should be taken to get the staminate sort with perfect blossoms by which means the imperfect varieties are fertilized. Some kinds of strawberries have blossoms which are imperfect; other varieties have perfect flowers. These last are called staminate, the former pistillate flowered varieties.

The staminate varieties marked (S), fertilize themselves. The pistillate, marked (P), must be planted near perfect flowering kinds, in order that the flowers may be fertilized. The pistillate varieties are the most prolific bearers. Always get varieties suited to your own locality.

One of the strongest growers is the Senator Dunlap (S). It is large in size, has a delicious flavor and is one of the finest market berries. Crescent (P) is a large, productive, and strong grower, also a good shipper.

The Bubach (P) is a good variety for home use and a near market. Many other varieties might be mentioned such as the Brandywine, McKinley, and the Marshall and Gladstone. These are all very good varieties to raise. Most plants do best by setting every other plant in the same row, 1 perfect, 1 pistillate. Not long ago "The Farmer's Voice" published the following list of strawberries furnished to that periodical by J. H. Hale. Being a well specialized yet completely arranged list it seems wise to reprint here for the convenience of strawberry raisers.

Earliest—Climax, Palmer, Excelsior, Fairfield, Parson's Beauty.

Latest—Midnight, Lester, Lovett, Arnot, Gandy and President.

Largest—Maximum, Mammoth, Midnight, Bubach, Mead, Auto, President, Morgan, Nick Ohmer, Sharpless Improved, Uncle Jim, Brandywine, Challenge, Climax, Glen Mary, Lady Garrison.

Great Yielders—Climax, Glen Mary, Mead, Parson's Beauty, Auto, Sample, Splendid, Haverland, Bubach, Dunlap, Excelsior, Arnot, Clyde, Kansas.

Best Formed Berries—Mead, Climax, Pride of Cumberland, Splendid, Warfield, Clyde.

Highest Flavored—Auto, Mead, Pennell, Palmer, Nick Ohmer, Brandywine.

For Light Sandy Soil—Splendid, Dunlap, Fairfield, Mead, Haverland, Excelsior.

For Heavy Clay Lands—Arnot, Nick Ohmer, President, Sharpless Improved.

Deep Red All Through—Challenge, Mammoth, Parson's Beauty, Warfield, Nick Ohmer, Glen Mary, Uncle Jim, Brandywine, Kansas, Mead, Pride of Cumberland.

Firm for Long Shipment—Pride of Cumberland, Warfield, Uncle Jim, Arnot, Challenge, Dunlap, Gandy, Lester, Lovett.

The Old Wild Strawberry Flavor—Palmer, Pennell.

Planting and Culture.

When selecting the ground for a new strawberry bed, choose a plot where strawberries have not been raised recently. The plants for this new bed should not be taken from last year's bed until they have started a new growth in the spring, as they are more apt to take root quicker and make a much better growth the first season. Always set the last year's growth of plants when planting a new bed. You can tell the difference between the old plants and the young plants by the roots. The roots of the old ones are black in color, while those of the young plants from last year's growth are a light color, almost white.

For large fields set the plants in rows three and one-half feet apart, and eighteen inches in the row. For garden culture, they can

be set eighteen inches in the row, and in rows twenty-four inches apart. After planting press the soil down close around the roots.

If the weather continues warm and dry, give the plants a light sprinkling of water for the first two evenings, after that, twice a week is sufficient. Then from twelve to sixteen hours after the watering, cultivate and keep the ground mellow and loose and free from weeds. Cut off all runners as fast as they grow.

The blossoms on the first year's planting should be cut off as soon as they begin to appear. If left to mature, the plant will be injured, the second year's crop will be short, and the berries also will be very much smaller. With proper care a bed may be made to produce three crops of fine berries.

In the home garden, irrigation may often be practiced to advantage. Strawberries, above all other fruits, delight in an abundance of water. Good tillage provides water; but it may sometimes be expedient to supplement tillage with irrigation. Surface sprinkling, unless prolonged, is usually worse than useless. Let the water soak down several feet in one place before directing it to another place. Irrigate deeply, or not at all. This applies to the watering of lawns as well as to the irrigating of gardens.

In tilling strawberries, always run the cultivator or rake through the same way each time. When a row is matted over two feet wide stretch a line and chop off and hoe up all the outsiders. Keep the row at this width by frequent uprootings; let all the strength of the soil go into the plants which have already set. Keep up tillage in the space between the matted rows. If you find an occasional plant which looks sickly and shriveled, dig it up and kill the fat, white grub which is eating its roots. This is the worm which becomes the June beetle.

Do not mulch the strawberry bed too early when the frosty nights come. Cultivate as long as possible, but when the ground is frozen hard, in the late fall, they must be covered with a mulch of straw, hay, or any horse barn litter. Do not cover more than an inch or two. Forest leaves make an excellent covering with a few light brush placed over them to prevent the wind and rains from scattering them abroad. That portion of the bed directly around the plants may be mulched heavily, but not the crowns of the plants.

It is a good plan before this last mulching and when the berries are all harvested to cut or mow the beds with a grass scythe, having the stubble about two inches high. Pull out all grass and weeds, also removing all rubbish from the bed and burn. Early in the fall place a thick covering of rotted barn yard manure between the rows and spade it into the soil putting a very light dressing among the plants. This will not only keep the fruit clean, but will prevent the ground from drying or baking; and thus lengthen the fruiting season. This should be done every year.

Old Strawberry Beds.

Old strawberry beds must not become overrun with weeds in the early fall, nor should the runners be allowed to set too closely. Eight or nine inches apart in the row, when matted, is a safe distance for

Strawberry bed at Hamline, Minn. Planted in April and photographed in October.

a good crop next season. There is one danger in using straw for mulching. This comes from the weed seeds in the grain and when the bed is to be a permanent one this is an item to be considered. But old straw is the least likely to contain seeds of much vitality. In putting this on distribute evenly so that the plants will not be smothered. If there is frost beneath the mulching there is no danger of this, but if snow does not come early, it is necessary to protect so as to avoid alternate thawing and freezing. In the spring as soon as warm enough but before removing the mulching, go through the rows and raise the mulching lightly with a hay fork just enough to give the plants a little air. This will prevent the plants from turning yellow.

Later in the spring, or as soon as the buds on the trees come out and the grass shows, remove one-thtird of the winter mulching from all plants that have been covered. If the weather continues warm and hard freezing is over with, one week later remove all the winter covering remaining. On a cloudy day, or in the evening, is the best time to do this, but be sure you do not uncover too soon. In case of late and untimely frosts, the following directions for protecting strawberry plants in small gardens will be of use to the farmer's wife: Take strips of cheesecloth about a foot wide and the length of the rows; if the vines spread to a width in the row of more than a foot, increase the width of the strips. Hem across the ends, and at each corner secure pegs about a foot in length, pointed at one end. On evenings when frost seems imminent, cover the rows with these stripes; drive or push the pegs into the ground at the end of the rows, until the cheesecloth is about four or five inches above the plants; then unroll the strips, stretching them to the opposite ends of the rows and fasten them down with the other pegs. In this way the plants are sheltered, the covering does not come in contact with them, one does not have to bother with newspapers that have to be weighted down and the strips are readily rolled up and put out of the way when not needed.

Strawberries the Second Season.

The best time to plant strawberries in the northwestern states, to secure a crop the next season, is the first week in August. To prepare the bed for the summer setting of strawberry plants, the ground should be heavily top dressed some weeks before using with the best of well rotted manure. This fertilizer should be thoroughly spaded into the soil, and all chunks of dirt broken up. When the soil for the bed is worked fine and mellow turn on the hose and give the bed a good soaking. Wait 24 hours for the water to settle into the ground.

If the sun is very hot set the plants in the evening after sunset, pressing the dirt around the roots with the hands. Twenty-four hours after planting give the strawberry bed a light sprinkling of water all over, but never when the sun is shining. Water this new bed every 24 hours for the first week after planting, the second week every third evening, and once a week thereafter until plenty of rain comes, always after sunset. Be sure to select your plants for this

August bed from the first runners that set in summer. If the layers are purchased from a near nursery or garden dig at once after a rain, and transplant directly to the new ground with a ball of earth about the roots.

Commence to cultivate the plants soon after planting them. Keep the soil loose and the bed free from weeds. In winter the bed should be covered with leaves, straw, or hay, two or three inches deep all over the bed. This should be done when the ground begins to freeze in November. No water should be allowed to stand on the bed where it will freeze and thaw. This means death to the plant. Strawberry plants must not be allowed to bear berries the first season.

Currants and Gooseberries.

One important point to remember in fruit growing is that fruit grown in the sun is worth twice as much as fruit grown in the shade. When shade fruit is exposed to the open air it perishes much sooner than a fruit that grows and ripens in the sun and it always has a poor, flat flavor. This is especially true of gooseberries and currants. Plant these in rows eight feet apart, running north and south, so as to let in the sun on the fruit. The plants should be six feet in the rows. Mulch heavily with horse stable manure, littering, or other coarse litter of straw or poor hay. In a hot, dry season this will hold moisture and protect the roots greatly.

Prune every year in the spring before the sap starts—about the last of February or the first of March. Leave from three to five of the most vigorous and upright shoots, but any old wood that shows signs of disease or that persists in sprawling on the ground should be cut out. Currants and gooseberries may be made to grow in bushes of a single tree-like stem in a warm climate. Weed out thoroughly grass and weeds. The lower the bush fruit of these sorts is cut down in fall, and the nearer the bushes are to the ground the better for them in cold climates and below zero weather, though currant and gooseberry bushes are sufficiently hardy to stand during the winter without injury. A mulch of barnyard litter about the roots will be of value in protecting them from drought and frost.

Coal ashes are almost worthless as a fertilizer, but they may sometimes be used to good advantage as a mulch for currant and gooseberry bushes. Wood ashes, however, are an excellent fertilizer and should be carefully saved.

Currants should be pruned so as to leave four to six canes in a bush, and all the young new sprouts that have grown from the roots should be cut out, about the 15th of June. If this is done the currants will be one-third larger and the bushes will grow twice as fast. However, if you want young branches to plant, leave some of the best young branches on the mother bush and cut them from it in the spring.

Plant them in the garden in rows about four feet apart, and about one foot apart in the row. Plant from four to five inches in the ground, leaving two or three buds above ground. Cultivate well

the first season, and the next season transplant to rows eight feet apart, running north and south, and seven feet apart in the row. Gooseberries should be planted and treated the same as currants.

Gooseberry bushes that are crowding each other may be transplanted early in the fall season better than in the spring. Soak the soil well about the plants that are to be removed before shifting them and keep as much soil around the roots as possible. After the plants are set, firm the soil well around the roots, and cut away old wood and any new branches that do not look vigorous. Mulch heavily, and if the soil is rich, while you will not have fruit the next season, you will have thrifty instead of weak looking bushes.

You can also bank the gooseberry bushes with earth, leaving the terminal branches to show through the banking. These will make roots during the summer. Divide them in the spring and plant in in three or four years, and produce a crop of late fruit of unusual size and good quantity and quality.

A novelty in the line of currants is called the Chautauqua Climbing Currant, and is said to grow to the height of some twelve feet rows where cultivation is possible.

Protect from Worms.

Spray the currants and gooseberries just as soon as the blossoms disappear, and thus destroy the first crop of worms which are quite sure to be followed by a destructive second crop a little later in the season.

The currant worm usually begins the season's work on the gooseberry bushes which come into leaf very early in the spring. Spray them soon and often for this green worm is the greatest enemy of the currant and gooseberry, and will soon strip them of their leaves. A mild poison, applied when it cannot harm the fruit, will destroy them. The worms hatch early and are so small at first that great injury may be done before the enemy is noticed. It is well to spray the bushes before you notice the worms, as the proverbial ounce of prevention is worth a great deal in this case.

Paris green or white powdered hellebore are both effective. If you have 100 bushes to dust, get 15 cents worth of hellebore and mix it with double its bulk of white flour. Put it into a cheesecloth sack and dust the bushes by shaking it over them after sundown or very early in the morning, while the dew is on. Be sure to treat all parts of the bush alike. If there is no rain for a day or two, one good application will destroy all the worms. But if a shower happens to wash off the poison before the worms have had time to eat it, it must be applied again.

Paris green is used the same way, except that it is a stronger poison and must be diluted. One tablespoon of poison to a quart of flour is strong enough. Many prefer to use the poison with water and apply it with a sprinkler. If used with water, allow two tablespoons of the hellebore and one of Paris green to a pail of water. Of course, in this form the poison may be applied at any time of day. Watch the bushes carefully and if another hatch of worms ap-

pears later, use the hellebore, for it is dangerous to use Paris green when the fruit is so nearly ripe.

After the currants are all picked don't stop using the Paris green solution for the rest of the season. The currant worm has several broods a year, and they keep on working at the foliage until late in the year. Unless you try the ounce of prevention now you are likely to have no crop worth mentioning another season.

Grapes.

There is an increasing demand for home-grown grapes, and if a vineyard of an acre or two could be planted and tilled on every farm it would be a paying occupation. Grape vines are best planted in the spring, but they can be successfully started in the fall if the planting is done early and the vines carefully protected during their first winter.

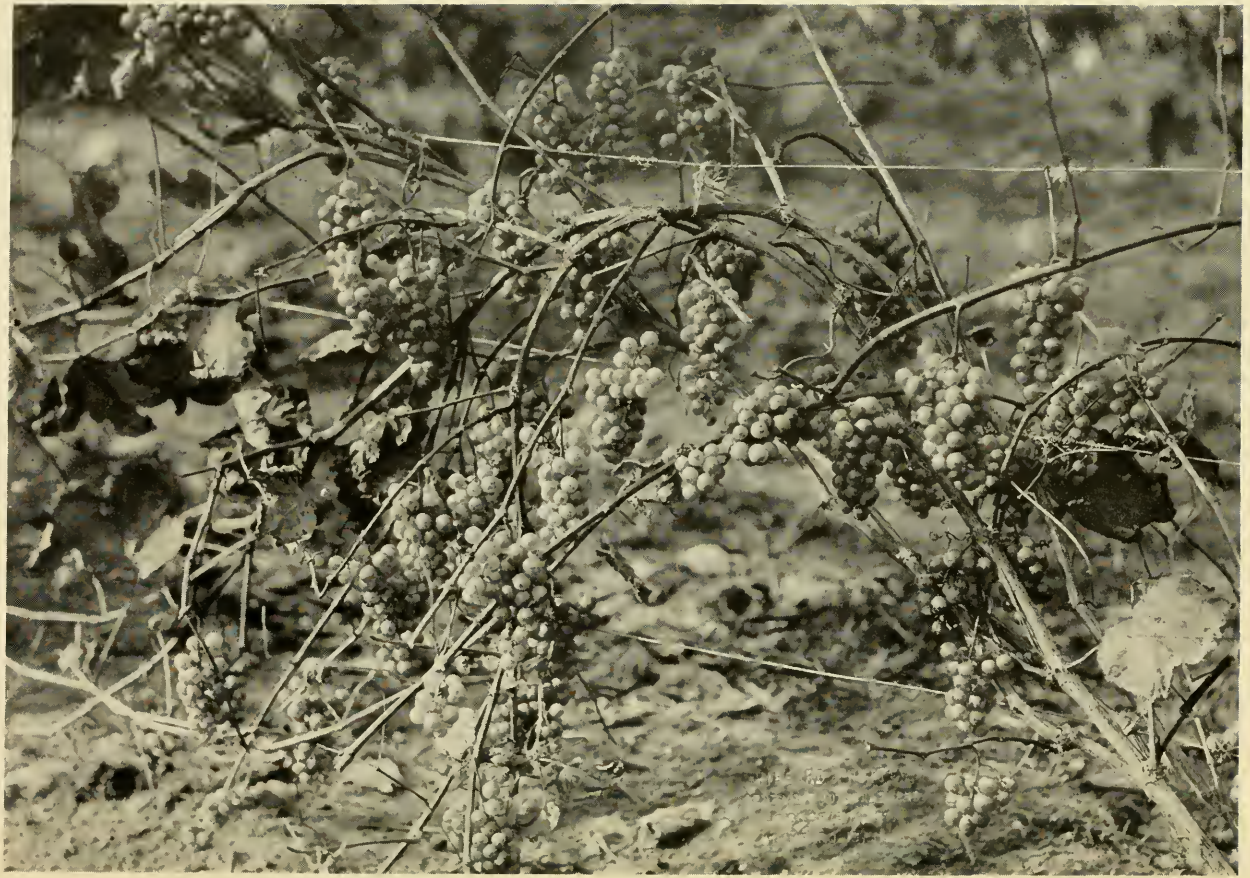
Grapes need a rich, strong soil and an abundance of moisture. Select a spot that has good surface drainage with a southern exposure. The ground should be thoroughly spaded up and prepared before planting, and cultivated and mulched often to keep the soil loose and mellow. Plant in rows 12 feet apart and 8 feet in the row, running north and south. This width allows of horse cultivation. Good varieties to plant are Campbell's Early Concord, Moore's Early, Worden, Janesville, Delaware, Agawam and Pocklington.

Grape vines should be trained, if possible, on trellises. These trellises are best when made of coarse galvanized iron fence wire. Set the posts, which should be seven feet long, three feet in the ground, leaving four feet above. Set them four feet apart and screw small hooks into the posts. Straight wire, looped at both ends is fastened over the hooks and stretched from post to post. By this method the trellis of wire can be separated from the standards and laid down with the grape vine undisturbed.

Cut back in the fall to two or three buds and cover up with leaves, hay or straw, six or eight inches deep. When the ground commences to freeze for winter, place brush or sticks on the covering to keep the wind from blowing it away. Dirt can be used where there is neither hay, leaves or straw. Uncover in the spring as soon as the frost is out of the ground.

Three canes to one root are sufficient to insure fine grapes. New canes need attention right through the spring in order to keep them from becoming too tangled. Remove shoots that interfere with training, and if there are canes that have no fruit on them, or but a poor promise of fruit, remove these, unless you need them for next season's wood. Two clusters near the base of the cane are enough to save. Pinch off the tips of the canes beyond these, after they have reached two or three buds of growth; except, as before, if you wish to keep for next season.

When the present season's growth becomes firm layers can be made by bending down one or two of the lower shoots on each vine to a shallow trench made in the soil and placing a shovelful of earth over the cane where it comes in contact with the soil. The end of



A prolific growth of choice native varieties of grapes. A. D. Axtell, fruit grower, Lake Minnetonka, Minnesota

the layered cane should be supported by a stake. A few incisions should be made in the cane where it touches the earth.

Pruning Grapes.

December is the best time to prune grape vines in a mild climate. In almost any climate, in fact, the weather is colder in February than in December. In March it is also apt to be severe occasionally, and later than that, the vines are likely to "bleed," if cut back as much as they ought to be. Grape vines ought to be cut back enough so that only a few eyes remain on a part of the new growth. If too much new growth is left on, some of the fruiting growth of the next year will be inferior and small. If the canes remaining are thrifty, the very few buds left will be ample for a good season following the December cutting.

It is also much easier to mulch largely after all the unnecessary growth is cut away. You are also saved a good deal of superfluous work if spraying is needed in early spring, or lye washing. Plow between the rows first, running the furrow as close to the vines as possible. Then prune, burn the refuse, and mulch with barnyard manure.

Use wood and coal ashes if you must, together, to kill out the grass. But if you can get your ashes separated use coal ashes alone. As to special varieties, your locality must determine, for you cannot raise California grapes in Minnesota. In our climate cover the vines with earth after the cutting and mulching, and then mulch with manure or straw again if the vines are very exposed. In general it is safe to follow the rule for pruning that enough old wood must be left upon the plants to support the wood to be retained of the past season's development. The canes which will produce the grape crop next fall are those which develop from the dormant buds on this season's wood and from 25 to 40 are enough of these buds to retain.

Remember, in pruning, that wood which has borne fruit once never bears again. The large canes are the same as the body to a fruit tree. It is the young wood that bears fruit.

Bagging Grapes.

When the grape berries are about as big as small peas they can be bagged. This process of inclosing the clusters in manila paper bags is not only a great preventive against insects and birds, but it keeps the fruit at a uniform temperature, so that it ripens earlier. Slit the bags in the center to about two inches and down the sides. These flaps are lapped over the cane above the cluster, with the leaf opposite the cluster protruding through the central slit. When arranged it is kept in place by pinning the flaps together.

Grapes need abundant moisture at the roots. All farm stock lost by sickness or accidents should be buried near the grape vine trellises.

Cutting and Layering.

Grape cuttings are generally made in the autumn. They should consist of the firm, well ripe, new wood and be from 10 to 12 inches

long. Tie in small bundles. These bundles should be set in the ground or packed in boxes of sand in a cellar where a temperature of about 45 or 50 can be had; set with the top end up and let them remain until spring. If wintered out in the ground they must be heavily mulched. In the spring the bundles should be placed in the greenhouse or hotbed for a few days, turned bottom up with three to five inches of soil over the butt end. The soil should be kept moist around them. They should remain in this position until they begin to show signs of growth. This will appear first at the butt end in the shape of a little ridge known as the callous, and it is from this ridge that the roots mostly develop. As soon as the little callous is well formed the cuttings should be planted, with all but the one upper bud under the surface of the soil, and thoroughly cultivated through the summer.

Growing grapes from layers should be done early in the spring, using the new growth of the preceding year for this purpose. For laying down the original canes, dig a trench four inches deep, place the cane in the trench and cover it. Pack the soil very firm over the same. If thoroughly cultivated throughout the summer, it will be well rooted by autumn, and can be cut off from the parent vine and set out as a new plant.

For mild climates cuttings of grapes may be made of the ripened wood in the late summer and planted directly in the ground. Cut first above a bud and have the cuttings of about three joints. Select a well drained and sheltered spot and plant the cuttings in rows three feet apart and six inches apart in the row. Plant so that the upper bud is just even with the soil surface and press the soil down firmly with the feet. As cold weather comes on cover these with at least six inches of leaves or straw. This must be taken off early in the spring and the bed cultivated through the summer. In the next fall the plants can be removed to their permanent places. Currants and gooseberries can be treated similarly.

Insecticides.

Conkey's Fly Knocker: An instant relief from the attacks of flies and other troublesome insects on horses and cattle. Flies not only carry disease germs from one animal to others, but sometimes drive cows and horses into a frenzy by their incessant attacks. Fly Knocker will drive pests away from the barn or other places where it is used. It may be applied very easily and at small expense by using the Excelsior Single Tube Sprayer.

Fir Tree Oil Soap: A popular insecticide for use on trees and plants, both in the house and garden. Properly applied it is sure death to mealy bug, red spider, black and green aphis, caterpillar, worms, scale, thrip, blight and slugs. It is also valuable as a remedy for skin disease on animals and for destroying fleas and other insects. This soap is a saponification of Fir Tree Oil with other ingredients prepared in a special way, which produces a more effective and much cheaper article than the simple oil. One ounce makes one gallon of liquid.

Formaldehyde: The loss to the farmers of the United States from Smut and other fungous diseases of wheat, barley, oats and other grains amounts to millions of dollars every year. The spores or seed of the fungus are on the seed grain which you plant; when the grain sprouts and grows the fungus grows, too; it follows up through the stalk into the blade and into the ear, and the result is blighted plant, smut grains and a diseased yield of inferior quality. The same holds true of Scab which has proved such a blight to the Irish potato crop.

Can you afford to use it? The price of a bushel of wheat expended for Formaldehyde will add several bushels to the next harvest. It takes as much land and labor to raise a light crop as a heavy one.

Tobacco Dust: For green and black aphis, fleas, beetles, etc. Splendid fertilizer and preventive for insects in the ground and around roots.

Sulpho-Tobacco, Plant and Animal Soap.

A sure, immediate and convenient exterminator of all insect life and vermin on plants, shrubbery, vines, small fruits and trees.

Non-poisonous and absolutely safe to handle. It will not injure the tenderest growth. A powerful fertilizer, reviving plants wilted from the ravages of insects.

For domestic purposes, it is valuable as an exterminator of moths, cockroaches, carpet bugs, etc.

Dissolve about two ounces of soap to a gallon of warm or cold water. Apply liquid, when cold, with atomizer or common sprinkler. The most famous florists and growers constantly and extensively use Sulpho-Tobacco Plant and Animal Soap, with gratifying results.

Stomach Poisons—For Chewing Insects.

Paris Green.—Use 5 ounces to 50 gallons of water. Always add 1 pound of fresh burned lime. In small quantities use 1 heaping teaspoonful to 3 gallons of water.

Lead Arsenate.—Use 3 pounds to 50 gallons of water. In small quantities use 1 tablespoonful to 1 gallon of water. Lead arsenate sticks better than paris green and is more effective.

Poisoned Bait.—Mix dry 1 peck of bran and 3 tablespoonfuls of paris green. Moisten the bran with sweetened water. Don't get it too wet. Distribute this in small amounts through your garden for cut-worms.

Hellebore.—Mix 1 part hellebore with 3 parts flour, and keep in closed vessel over night. This may be used on vegetables or fruits that are about ready for the table. Hellebore may be steeped in water, 1 ounce to 1 quart of water, and sprayed on.

Contact Poisons—For Sucking Insects.

Lime Sulphur.—Slake 20 pounds of fresh burned lime. Add 15 pounds of sulphur. Boil in 25 gallons of water for one hour. Dilute to make 50 gallons. This is a winter spray only.

Kerosene Emulsion.—Dissolve 1 pound of hard soap in 2 gallons of hot water. Remove from fire and add 4 gallons of kerosene. At

once churn violently, until a creamy emulsion is formed. Dilute this with water so as to have 10 per cent. of kerosene oil in your spray for summer use, or 15 per cent. for winter use.

Tobacco Water.—Cover tobacco stems with hot water. Allow to stand over night. Dilute the resulting liquor with 3 parts of water.

Pyrethrum.—Mix with 3 parts of flour and keep in closed vessel for several hours.

Soap Solution.—Use 1 pound of soap to 8 gallons of water. This will be found excellent for plant lice, scale on house plants, or for any of the soft-bodied insects.

Whale Oil Soap.—For winter use dissolve 2 pounds in 1 gallon of water. For summer use dissolve 1 pound in 4 gallons of water.

Bordeaux Mixture For Garden Plants.

The copper sulphate of bordeaux mixture is dissolved by crushing it in a burlap bag and then hanging the bag and its contents in about three gallons of water several hours before the mixture is made. Of course this mixture is not to be advised for ornamental leaved plants, as spots follow for several weeks after use. Pick off from such all spotted and scarred leaves and burn them when blight and rust appear. This helps to keep down the spread of the disease. Often, by keeping the soil well cultivated and the plants very dry except for cultivation, you can cure the trouble without the mixture, especially if dry sulphur is sprinkled or blown on the leaves.

Tobacco Thrip.—Experiments show that the common rose leaf insecticide, which is made of tobacco, will not destroy insects on the tobacco plant. These insects are accustomed to partaking of the plant, and no decoction made from it will have any material effect on them. It used to be thought that the insecticide was an effective remedy, especially for thrips. But several simple methods of overcoming the bothersome thrip may be followed with excellent success. One is to keep the ground perfectly clear of all catch crops between crops of tobacco. It has been found that the thrip will pass this period successfully on any of the common small grains and on many of the weeds. By keeping the field free from all of these its increase can be prevented. Another simple method is to keep a border of ten or fifteen feet on all sides of the field free from vegetation. This border, however, may be planted to corn with nearly as satisfactory results.

CHAPTER XI

The Orchard

THE writer has had a large experience and has come into contact with hundreds of people who have consulted him and asked for advice in regard to farming and fruit-raising. He finds about one in every hundred who thoroughly understands these two very important branches of industry. This is especially true of fruit-growing, for many intending or actual fruit growers seem to think that orchards will be a commercial success without any care save Nature's bounty.

The future of fruit culture it is difficult to estimate just now, as so much depends upon how successfully the cold storage business is to be controlled. The danger from over-production of apple raising, which is such a bugbear to so many people, need not deter any man from going into the business of apple culture. Fruit raising of all sorts is a money-getting occupation, if the fruit raiser can keep out of the hands of the speculators and so manage his crop that he sells on an advancing market.

Small fruits must be sold at once, but the apple yield, of some sorts, is a product which can often be held back until late midwinter at a decided gain to the apple farmer. The demand for fruit increases every year, with a supply far behind it. There is hardly a farm in this country where fruit of some sort cannot be grown by an intelligent and industrious worker. Find out what sort of fruit is suited to your locality, or your own soil and then begin by trying its culture on some plot of your ground. By this method of going slowly at first you can give your fruit plot a fair chance without that anxiety that comes from putting all your eggs in one basket.

Prof. H. J. Eustace gives some interesting figures on the mature orchards of western New York. One orchard of 11 acres, near Rochester, produced fruit in 1902 that sold for $3,588; in 1903, $4,400; in 1904, $1,944; in 1905, $3,681; in 1906, $2,627; and 1907, $4,200. A neighbor's orchard of mature trees brought in 1905, $4,278; in 1906, $4,464, and in 1907, $7,892. Another of 25 acres brought in 1905, $9,582; in 1906, $4,733, and in 1907, $11,080.

The testimony of another eastern farmer is that "if every discouraged farmer of the present day who is in the temperate grain belt, would try planting ten acres of his best land to an apple orchard, in ten years he would be making daily trips to the bank to deposit dollars, instead of trying to borrow them. Each year's growth of the trees will also be adding hundreds of dollars to the value of the farm. The cost of the investment is small, and hardly any man is too old to try the constant, but not severe, labor of fruit raising." These are optimistic, but very probable views.

Sites and Soils.

Wherever practical, anticipate your planting of an orchard, of any sort, by two or three years, practicing a rotation of crops. Deep plowing cannot be done in bearing orchards, and the soil must be thoroughly prepared before you put in the spade to set your trees. Lime soils are a great help in fruit raising. In general a porous clay loam, tending toward sand, is the best, such a soil as maples, elms and lindens do well on. As to location, a hillside is a capital place, though plenty of good orchards on level land are found all over the States. Plants liable to be injured by sudden climatic changes ought never to be planted on a south or west slope, as the chances of frost upon a too early blooming must not be risked. This is very true of peaches and strawberries, which are early bloomers. On the other hand, high colored fruits ought not to have a northern or eastern slope. Steep hillsides are hard to cultivate; therefore I recommend a slight slope with a different exposure for different varieties of fruit.

For a stiff, heavy clay, green manure well spaded in will do a great deal to lighten the soil. You cannot work in the mulch too thoroughly and the rough ground should be cultivated again and again, until the soil is thoroughly pulverized. Don't work on such a soil when it is wet, and, if possible, let the broken ground go in the rough through the winter. Frost will powder it up better than hand cultivation often.

For a sandy soil and small orchard, get a few loads of good soil to mix in with the sand; thus treated a light sandy loam makes a good orchard soil. Four to six inches of good soil mixed with the same proportion of stable manure and thoroughly and deeply plowed in will insure a fine orchard.

Corn is a good crop to plant when preparing orchard land. Deep plowing, turning under green manures, and the growing of such a crop insures the thorough preparation and after tillage which must be done in order to make your orchard a profitably bearing one.

Methods of Planting.

Apple orchards begin to bear in from three to seven years of the time of setting out. Apples and pears can both be planted in the fall. Get strong two-year-old trees for fall planting, however. Peaches and almost all stone fruits should be planted in the spring, as it is quite certain that a cold winter will kill most fall set stone fruit. But hardy fruits should be planted in the fall, and among these the cherry should be listed, as for some reason, spring planting fails with this fruit. Get strong two-year-old stock of cherry trees and set in the fall as soon as the trees have dropped foliage. Sweet cherries need a great deal of room and must be planted twenty-five to thirty feet apart. These do not need so rich a soil as the sour cherry, which needs a heavy loam. Sour cherries can be set from sixteen to eighteen feet apart.

In setting out apple and other fruit trees, dig holes three feet deep and three feet across. Fill in the bottom with fourteen inches

of well rotted manure with two quarts of salt mixed through it. This helps to hold moisture. Tread down hard and firm and add six inches of good black soil. Set the tree on this. Fill in around the roots well with mellow, rich earth and to the top of the pit. Mulch above with coarse stable littering or straw—anything that the wind cannot blow away. Lime is a good fertilizer mixed with manure and well spaded in, as has been said previously.

Directly after planting apply a thick mulching of well-rotted manure. Small trees need this four feet in diameter. Four to ten inch trees need six to eight feet in diameter. One load of this dressing will be needed for a tree eight to ten inches in diameter or for four three-inch trees. It should be applied from six to eight inches in depth. Spade this mulching well into the ground the second day after planting. Cultivate with a fork spade every ten days thereafter, but use great care not to disturb the roots of such newly set stock. Continue this through the fall as long as the ground can be turned, and begin again early in the spring, when the soil is full of moisture. This conserves the water in the soil and prevents later dryness. When the first dressing has been well spaded in a second one should be given to retain moisture during the summer. Through any season of mulching, it must be well worked into the soil. In mulching see that the dressing circles out as far as the outside branches extend. Hoed crops in an old orchard do no harm, if well cultivated. In fact, some orchardists plant squashes and cultivate with two horses where the orchard is a large one.

Dynamite In Orchard Planting.

One of the most modern methods of orchard cultivation is that of the use of dynamite. In a recent issue of an eastern paper was an article showing the good results from planting trees with dynamite in an 800-acre orchard owned by the Missouri Valley Orchard Company, near Neely, Kan. The methods were practical and not dangerous. With a two-inch auger a hole thirty inches deep is bored in the spot where a tree is to be planted. The depth of the hole depends largely upon the nature of the soil. The object is to penetrate into the "hardpan," a clay-like substance impervious to water and impenetrable to tree roots. Half a stick of especially adapted dynamite of comparatively low strength then is tamped into the hole and shot.

The low power dynamite not only is less dangerous to handle, but instead of tearing a large "pocket" in the ground, as the higher power kind does, it merely loosens the ground downward through the "hardpan" and around it for a radius of eight or ten feet.

The soil is barely lifted by the explosion. The ground now is ready for planting the tree. The "hardpan" has been broken so the moisture from below can nourish the roots of the young tree—a great advantage in dry weather—and the soil above the "hardpan" has been loosened more thoroughly than would have been possible with any amount of plowing or digging.

The cost for each tree planted in this manner averages about three cents. Tests, it is said, show that trees planted with dynamite

make an advancement of about two years in growth and fruiting over those planted by the old method.

Varieties.

Plant trees adapted to your own locality, eastern grown for the East and western for the West. Occasionally try a new variety; but a variety not adapted to the climate in which it is to grow is likely to be short lived with small yields, and difficult to grow at the best. An eastern apple grower has given me the following list as likely to secure the best results for eastern sections:

Summer varieties, Oldenburg, Gravenstein and Red Astrachan; fall varieties, Maiden Blush, Fall Pippin, Wealthy and Northern Spy; winter varieties, Baldwin, Rhode Island Greening, York Imperial, Grimes Golden, Jonathan, Tompkins King, Stark and Ben Davis.

Of these he recommends the Baldwin and the Rhode Island Greening as the best.

In the Northwest, however, for a commercial orchard, a practical fruit grower gives this plan, which I copy verbatim, for setting out an acre of trees:

In the spring run 6 rows parallel with the front of the orchard, 15 feet apart, then 6 more rows, 20 feet apart, and 10 transverse rows, 20 feet apart. On one side take 6 rows for plums, on the other, 6 rows for crabs; the 6 rows in the rear being for standard apples. Of plums plant DeSota, 4; Weaver, 2; Rollingstone, 3; Cheney, 3; Aitkin, 3; Wolf, 3; Wyant, 4; Forest Garden, 2; Surprise, 6; making 5 rows in front, with 6 in each row. Of crabs, plant Martha, 4; Minnesota, 2; Whitney, 4; Gideon's No. 5, 2; Virginia, 3; Lyman's Prolific, 3; Early Strawberry, 2; Florence, 4; Darit, 2, and Compass cherry, 4; making 5 more rows of 6 each. That will leave six rows across the rear of the orchard for apples. In these plant Longfield, 3; Malinda, 3; in first row; Northwestern Greening, 6; Duchess of Borovinka, 6; Wealthy, 12; Okabena, 6; Patten's Greening, 3; Peerless, 3; McMahon, 2; Wolf River, 2; Blushed Calville, 2; Hibernal, 3; Charlamoff, 3; Yellow Transparent, 2; Repka Malenka, 2; Anisim, 2.

Distance Apart.

As regard the distance apart of these trees, I think, from my own experience, that different fruit trees require different distances; and I incline to the latest method of thirty to forty feet apart, for apples each way according to variety; dwarf apples, ten to fourteen feet; pears, twenty to twenty-eight feet; dwarf pears, ten to fourteen feet; sweet cherries, twenty-five to thirty feet; sour cherries, eighteen to twenty feet; quinces, ten to fourteen feet.

In a small home garden the minimum distance may be used. For this purpose the varieties of dwarf trees are best. If set in the fall ten feet apart, or in any of the unoccupied places about the grounds and outbuildings, the amateur fruit grower can get a liberal training in fruit raising of the hardier sorts, and at the same time beautify his

homestead. If such trees are set in a favorable location, with rich soil, and well watered and cultivated, they will grow four times as fast as in an orchard, and in the satisfaction of learning how to make fruit raising pay they will prove invaluable to the doubting Thomases of this business. But they must be treated right and never neglected, in order to give a fair trial.

Transplanting.

Rainy days are the best for transplanting trees and vines. But I have transplanted in June and July in exposed places with good results, by mulching heavily with straw or hay from five to six inches deep and about four feet in diameter around vines and shrubbery, and watering every eighth evening. I have transplanted three year old grape vines, canes nine to twelve feet long and in full leaf in the middle of July, when no trimming or cane cutting could be done. Two-inch elm and linden trees in full leaf were also transplanted the eighth of June. These all lived and made good growth. Great care must be taken to shade shrubbery and vines through the day, however, for from two to three weeks after late transplanting. This sunshade must not lie on the plants, but be lifted to leave an air space of from two to four feet. The same method of protection by a covering which leaves an ample air chamber will often preserve flower beds and shrubs in bloom after frosts until late in the fall.

Propagation.

As a general rule, the seeds of fruit are of little or no value in the production of new plants, unless the seedling trees are budded or grafted. This is especially true of seedlings from peach tree pits. Cions for grafting are best cut in October or November, according to the locality. Cut them to three or four bud lengths, tie the varieties in bundles, label, and bury in boxes of sand until time for spring use. If one wishes to get nursery plants, a few dollars will get enough apple trees to plant an acre. If these are set out with the care directed here, and all the hardy ones planted in the fall when farmers have the most time for this detail work, they will, in a few years, get ten times as much profit from one acre as they could from corn or potatoes.

But if any one insists upon experimenting with seeds, plant apple seeds in sandy soil, in the fall, in a well drained plot, where ice will not form. Mulch with leaves heavily, putting fence brush above. Remove the brush in the spring. The seedling usually needs no protection.

If, as a further experiment, you wish to plant the peach pits, dig up the soil deeply in a fertile portion of the grounds and plant the pits singly three inches deep in the fall. Next spring the seedlings will appear and if the trees stand far enough apart they can grow unmolested until bearing begins, requiring only to be pruned, cultivated and fertilized annually. If it is not convenient to plant the pits in the fall they may be held over until next spring in a box of damp earth.

As a rule, Winesaps, Spitzenbergs, and Bellflowers are sterile when planted alone; likewise Susquehanna peaches and Kiefer, Bartlett and Angouleme pears. But Baldwins, Rhode Island Greenings, Ben Davis and Fallwater apples, Lawrence and Seckel pears and green gage plums do not need fertilizing. Certain fruit trees are sterile when isolated. For this reason bee-keeping is a valuable factor in fruit raising, as the bee distributes the pollen of the blossom. It must be remembered, however, that scarcely one fruit blossom in ten sets fruit, even in the most favorable conditions, and where the trees are of the most productive varieties.

Cultivation.

Cultivating and fertilizing next become the two most necessary labors. Haul on the orchard land from fifteen to twenty-five loads of barnyard manure, spread it all over the ground, and plow it into the soil late in the fall or very early in the spring. Cultivate once a week until the fruit is harvested.

The writer tried this in the summer of 1910, when there was scarcely any rain. He found that there was plenty of moisture, even more at the end of the three months than when he began mulching.

For any one to become a scientific fruit grower, he must understand this fact of conservation of moisture. In caring for our orchards in the past, we have put off too long the cultivation of them after heavy or excessive rains. The best horticulturists now agree that cultivation of the orchard should be begun, in all kinds of fruit orchards, from 12 to 24 hours after a heavy rainfall, or as soon as the water has settled into the ground. Deep cultivation, from 4 to 6 inches in depth, will conserve the greatest amount of moisture. During the rainy season the ground must be cultivated in order to make ample reservoirs to hold the water during the dry part of the season.

For ten days during the entire season, in long bearing orchards, where the limbs of the tree are too near the ground to be cultivated with horses, the ground should be well spaded with a forked spade, and should be heavily mulched. If you wish to get the largest returns from your fruit orchard cultivate and spray thoroughly throughout the entire season.

Mulching Early a Protection From Too Early Blooms.

Early mulching is a sure preventive of the too early blossoming of fruit trees. In the Northwest the best time to mulch fruit trees is about the first of January. Straw, horse stable litter, and wild grass hay all make very good mulching for fruit trees. The object is to keep the frost in the ground and among the roots of the fruit trees and thereby keep the tree from budding too early. If the mulching to be used is dry, light stuff, cover the ground around the fruit tree from 12 to 16 inches deep. If, on the other hand, the mulching to be used is wet or partly rotted, cover the ground around the fruit tree only from 8 to 12 inches. Cover all the ground to the same depth under the head of the tree, varying according to the size of the tree's head, probably from 12 to 20 feet in circumference.

This mulching will keep the frost in the ground around the fruit tree from two to three weeks later in the spring. We find often in the valleys that the fruit crop is lost from the late spring frosts. By mulching heavily we keep the fruit buds back until the late cold rains and frosty nights have passed over. A long, cold, rainy time with an east wind, when the fruit trees are in bloom, is ruinous to the fruit crop. No mulching should be removed from the fruit orchard in the spring, but should be left to rot and retain the moisture in time of drought.

Cover Crops.

Cropping a fruit orchard in some localities, often results in more and better fruit, while the labor is greatly lessened. For an orchard which has been in bearing many years, this is specially true.

Seeded down to clover the sod mulching conserves moisture and enriches the soil. By the middle or last of July in average climates, any cultivation should end. Cultivate often during the last weeks of this period, getting at least five or six workings in the last three. Then put on a cover crop of the crimson clover, to be sown not later than the middle of August. If there are any hollow places near the fruit trees, either fill up or arrange a ditch to drain off surplus water. Anything of this nature must be kept away from fruit trees in the winter. In the spring plow up the cover crop. If it can be enriched by stable manure late in the fall, so much the better for the trees. Follow the plowing by harrowing, and keep this up by the spike-toothed harrows after rains and at least every ten days between rains.

If an orchard is to be pastured for pigs, calves or sheep the trees must be enclosed. Set four short posts around each tree. Upon these, boards can be nailed, or barb wire wound on the outside. Set the posts about four feet from the body of the tree and about three feet above ground. Only bearing orchards should be sown to a cover crop, and clover is the best for this purpose. Pigs pastured in this way will eat up the windfalls, which are excellent for stock; in fact, the bearing farm orchard is unexcelled for a pig pasture.

Twice a week during the fruit maturing season the trees must be carefully gone over and the ripe fruits picked. Apples, peaches, pears, plums, cherries, ripen their fruit at different periods, and of each of these the products mature at different times.

Pruning Trees.

The orchardist, whether he is growing fruit for pleasure or as a commercial venture, must begin his pruning with the first year of planting. Get the main branches formed at once—"not less than three nor more than five"—and radiating out from the stem at different heights around it, like wheel spokes. Three branches from each of these main branches, and three twigs upon each branch is a safe rule to follow.

This frame work makes the foundation principle of all later growth and later pruning, making due allowance for the varying

growth habits of varieties of fruit. As a rule heavy pruning is not wanted; but annual, even attention to each year's growth does not need heavy pruning. If a tree is weak, or diseased, it is advisable to prune the top heavily while it is dormant, as each cutting back will give the top growth new life, and often restore the tree to vigor and health. Trees in normal condition need only the removal of suckers and superfluous twigs and branches after they begin to bear. Shape the tree before bearing.

If the trees set out are only one year old, the side branches are weak. These should be removed and the main stem cut back to the point where the tree is to form its head. If they are two years old, cut away all but the main branches already mentioned, and cut these back to three bud stubs, possibly four.

General Directions.

The Colorado experiment station gives the following general directions for pruning:

1. Prune to modify the vigor of the trees, giving it less top to support, allowing the sap to flow into the remaining branches.
2. Prune to produce larger fruit than could be produced if the vital forces of the tree were divided among a greater number of branches.
3. Prune to give the trees desirable shape.
4. Prune in summer to change the trees from wood-bearing to fruit-bearing.

The best time to prune such fruit trees as apple, plum and cherry, is after the frost is out of the ground in the spring and before the tree blooms. All fruit trees should be pruned so as to keep the head of the trees as close to the ground as possible, and thus protect it from the hot suns. In the northwest there should not be removed from the trunk of any fruit tree any green, thrifty limbs. From the top of the head of the trees there should be cut back one-third of last year's growth, and also some of the little twigs in and around the center, so that the sun can shine in on the growing tree and fruit, which will improve its flavor. Shade always impairs the flavor of the fruit.

All fruit growers, though, do not agree as to the time of tree pruning. In Iowa it is the habit of some farmers and fruit raisers to do pruning when the tree is in full bloom. They claim that by trimming then, the location of the blossoms is a help in pruning so that a tree will bear fruit more evenly.

Apple, Pear, Cherry and Quince.

Apple, pear and quince trees can also be pruned early in the fall. The apple fruit grows on twigs that are, at least, three years old, and care must be taken in pruning not to confuse these with the non-bearing branches; as only a small part of the bearing wood should be cut each year. Regular yearly pruning is specially needed in apple orchards, whether large or small, as this tree develops very rankly, and too much wood is formed at the expense of fruit. With a young

The above orchard is situated six miles west of Wyoming, Minnesota, near Lake Lynden.

apple tree leave from three to five main branches radiating at different points from the trunk. This central head should begin not less than three feet from the ground nor more than about four and a half feet. Keep this form for the tree until the time for bearing comes, seeing to it that the branches are evenly distributed, cutting back the leading shoots so that the tree will not grow too high, and that the head may be kept full and bushy, without interfering with the admission of plenty of air, light and sunshine to the top. Keeping the trees low and open is also necessary to help spraying and harvesting. Moderate pruning every year, done in this way, will reduce greatly the need for excessive pruning after the tree begins bearing.

Pear trees are pruned in about the same manner, except that, in pruning the young tree, head it about one foot lower. The pear's natural habit is to grow tall and spindling. Prune this tree so that it will spread out and the inside growth will not be dense. Cut the main branches back annually to an outside bud, as the last bud left should point in the direction to which you want the tree to grow. If the bud is left on the outside of the pruned branches, this will send the new growth outward.

Cherry trees, also, are likely to grow tall, unless the spreading habit is enforced by severe and annual pruning. After a broad and open top is produced, however, the orchard needs but little pruning. Wood two or more years old produces cherries. Keep the young tree down to three or four main branches, set at different points along the stem, and heading out about four feet from the ground. Bearing trees need chiefly such pruning as will keep the head open to light and air, and remove all dead or broken branches. Cherry trees left to grow as they will, reach fifty feet or more often.

Head quince trees low, from fifteen inches to two feet from the ground. Leave four or five main branches. Quinces grow at the ends of shoots two or more years old. Head back leading shoots after they reach two feet.

Peaches.

Peaches produce their fruit on wood of the previous season's growth. When you are pruning bearing trees cut back such shoots, late in March or early in April, about one-third or one-half. This thins out the fruit buds enough, but not so much as to minimize the crop. By following this process the bearing wood for the next season's crop is much better assured in plenty. Of course, before beginning the pruning of the bearing shoots, all the dead wood must first be cut away, and also the interlocking limbs. A peach tree grows out chiefly from the tips of the branches, and is likely to get a straggly, untidy habit of growth if not kept well headed in and its inside branches cut out annually.

In starting the young tree leave the main branches not much more than eighteen inches long and from eighteen to twenty-four inches high. Later pruning will be decided by the habit of growth of the peach trees you have. Some peach trees grow in pyramid form, that is, with one central branch from the ground to the top,

and main branches growing out as laterals. This kind of a tree can be pruned more severely than the other, or vase-form, where from a short main trunk several branches come out and grow upright. With this form, which is the most desirable, pruning of the main branches is likely to do great harm after the first year. Get your tree headed as low as possible the first year of setting out, and then prune to keep the tree open and spreading.

Plums.

Plum trees do not need so much pruning as some others. For young trees follow about the same method as for the peach. The plum tree, which grows upright, should be kept headed back and the main branches pruned to a bud pointing outside. There is a variety which grows out in a scattering fashion. The main branches of these trees must be pruned to an inside bud, or one that points inside. Some plums bear fruit on wood of two years' growth. Others are like the peach, with bearing wood of but a season's growth.

If your plum trees are of but one variety, it will be best to plant trees of another kind among them, as some plum trees must be pollenized from other varieties. Take great care that plum trees don't grow too much to wood. If you find they do not bear when the proper time comes for bearing, try giving a good stiff dose of pruning, and leave it with the present season's growth one-third cut away. Sometimes plums have a way of bearing so heavily that they suffer for several seasons. Care must be taken in pruning that a tree of this habit is carefully pruned as to fruit buds in the early season.

Pruning Tools.

The proper pruning tools are: two shears, one for hand work and the other a pole shears, for work on the upper branches; two saws, large and small, or a pruning saw in place of the small saw; a chisel, ladder and rope. The cut should be made close to the parent stem or twig, and no stubs left. A close cut gets the full benefit of the mounting trunk sap, which heals the wound before disease germs can get in their work. As a sure prevention, however, it is best to paint over all large cuts with lead paint of the right tint. Cut smooth and use the chisel for smoothing off.

Lead, yellow ochre, coal tar and grafting wax are all good coverings for cut surfaces. Anything which is not corrosive or hurtful to growth and which will keep the heartwood from rot spores is good.

Making Over Old Orchards.

The following method of making old trees new has been practiced by Mr. Vescelius, an Iowa fruit grower, who says he regenerated his orchard of 600 apple and peach trees by the process; so much so that in the fall they were overweighted by their load of fine fruit:

"When the frost is well out of the ground and the weather is warm," he says, "remove all the dirt from about the trees down to the roots for about three feet around the trunk of the trees, and leave the top part of the roots bare for about three days. Then hoe all the

dirt back again, which will leave it some higher close to the body of the trees.

"In this time that the roots are bare you will see them turn from a dark to a pink color. You will also find that your trees will be full of good, healthy blossoms and later they will be loaded with fine, healthy fruit, all smooth and nice and of a much finer flavor than before. It will surprise you to see the increase in the amount of fruit and improvement in the quality."

The question of declining apple orchards has been one which has been taken up in a scientific manner in Germany, and the German papers have been giving a good deal of attention to the matter. A brief outline of some of their experiments shows that commercial fertilizers were heavily applied.

Of five long rows of apple trees, one row was left untreated and the four others had different combinations of manurings. The row left unmanured gave 104 pounds of apples per tree during the five years from 1900 to 1904, both inclusive, and in the fifth year (1904), which was the year of maximum yield for the entire orchard, the weight of the apples per tree was 55 pounds and the number 294. The best results from manuring were obtained by a complete manure, consisting of 1⅛ pounds of sulphate of ammonia, 1½ pounds of muriate of potash, 3½ pounds of basic slag per tree per annum, applied to the roots during the winter.

During the five years the yield per tree from this dressing was 163 pounds of apples, while by the fifth year the bearing increased to 401 apples, weighing 105 pounds per tree—that is, the weight of the apples per tree increased by this manuring from 55 pounds on the unmanured trees to 105 on the manured trees, or 90.9 per cent; while the number of apples increased from 294 to 401 per tree, or 36 per cent. The increase in the average size of the apples is remarkable. Those from the unmanured trees averaged 2.98 ounces each, and those from the manured 4.19 ounces each.

In a corresponding experiment with pears (Josephine de Malines) similar results were obtained with a dressing consisting of 3 pounds of nitrate of soda, 2¼ pounds of muriate of potash, and 5 pounds of basic slag per tree. In 1904 the yield was 14¾ pounds per tree from the unmanured trees and 80¾ pounds per tree from those manured with the mixture.

How to Top-Graft An Unprofitable Orchard.

From "Garden and Farm Almanac"

There is a peculiar fascination for most men in the idea of making over an old orchard by top-working with some better sort and changing the varieties of an unprofitable orchard into something palatable and paying. Contrary to the notion of many, there is nothing especially difficult or mysterious in the process, and any enterprising man can do it for himself. Grafting is done preferably while the tree is dormant, just before the growth starts in the spring. The stubs to be grafted should be from an inch to three inches in diameter. One and a half to two inches is best. Cut the stubs off with a sharp saw. Cut them from all parts of the tree so that after the grafts are

growing and all other branches have been removed the tree will have a shapely and well-balanced top. In preparing the tree for top-grafting it is well to leave some branches untouched to supply foliage till the grafts are started. Aside from the pruning saw, the tools needed are a mallet and a grafting knife. Grafting knives are commonly sold by nurserymen, or if you prefer you can have the blacksmith make one for you of an old file. The blade has a heavy back so that it can be driven into stubs to split them; a hook is commonly made upon one end for convenience in handling. On the other end is a narrow wedge for holding the stub open while the cions are inserted. Be careful not to split the stub down farther than necessary to receive the cions.

Cions for top-grafting should be dormant. It is well to cut them the previous autumn and store them in a cool place which is not too dry. One of the best ways to keep cions is to pack them in layers in a box of sand in the cellar. Let the sand be slightly moist, just enough so that the cions won't shrivel. Always cut shoots for cions from the end of bearing wood. The cions must be of last year's growth, never older. Do not use water-sprouts, because the buds are not well developed and they are not so likely to grow into good bearing wood. The cions should be cut from four to six inches long and after a little practice, may be shaved properly with two quick strokes of a sharp knife. Make them in the shape of a wedge with about an inch to an inch and a half taper, having one side thick and the other thin. At the top of the wedge on the thick side leave two buds. Two cions are usually put in each stub, one on each side unless it be too small. The stub heals over better in this way and there is greater certainty of getting a successful graft. When they are inserted the cions are leaned apart slightly so that there is more likelihood of the cambium layer (the part of the bark where the growth takes place) of stock and cion touching. The best size for the cion depends somewhat upon the size of the stub, a quarter of an inch in diameter being an average size. They should be pushed firmly in.

Subsequent Treatment.

After the cions are properly inserted, knock out the wedge of the grafting knife, which has held the split of this stub open, and cover all the crack carefully with good grafting wax. This should be prepared beforehand and must be warm enough to work easily in the hand. The hands are thoroughly greased to prevent its sticking. There are many formulae for making grafting wax. The following, one of the best, is recommended by Fletcher: "Rosin, four parts; beeswax, two parts; tallow, one part, all by weight. Break all the material into small pieces and melt together. When all melted and thoroughly mixed, pour the hot mixture into a pail of cold water. When it is hard enough to handle, grease the hands with hard tallow or cheap vaseline, and pull it until it becomes light colored like molasses candy. Be sure that the rosin is all melted and do not have it appear as little lumps in the completed wax."

For use in cold weather, when the above will not work, take 6

pounds rosin, 1 pound beeswax, and 1 pint linseed oil; apply this hot all over the joints with a brush. It should be put on one-eighth of an inch thick.

For use in warm weather the following is used: 4 pounds of rosin, 1 pound of beeswax, and from half a pint to a pint of raw linseed oil. Melt all together, gradually turn it into cold water and pull. The linseed oil should be entirely free from cotton-seed oil.

The waxing is an important part of the operation and must be thoroughly done. Wax the cracks in the stub first, then cover the top of it carefully, about the base of the cions. Put a little on the end of the cions to prevent drying out. Don't be afraid of using too much wax, as the life of the cions and the success of the grafting depends upon keeping out all water.

Spread the wax on the joint about ⅛-inch thick. When this has been spread evenly over the joints a stout cotton bandage should be applied and tied or sewed with a strong cord. A sack needle is good to use if sewing. The object of the wax is to keep the joint from drying out and giving them the best condition under which to unite. The bandage prevents the sun from melting the wax.

The following summer if both grafts on a stub have started to grow, the weaker should be removed. Neglect of this often destroys the usefulness of both cions by too close crowding. At the same time the remaining branches of the original stock may be removed, so that all the strength of the tree will go to developing the grafts. With a little practice every fruit grower can successfully do his own top-grafting. If he prefers, however, to hire it done, he should at least cut and prepare his own cions and not run the risk of getting water-sprouts or undesirable varieties from a professional "grafter." A successfully top-grafted orchard will be bearing good crops of its new sorts in three or four years after grafting.

Danger from Early Frosts.

The danger from early frosts to the commercial orchard has been such a serious matter in the past few seasons that several western fruit growers are reported, in the daily press, to have installed oil stoves in large orchards. The latest of these reports is that a fruit grower of Hutchinson, Kansas, has ordered thirty oil stoves per acre for his orchard of 600 acres. The stoves hold ten gallons of oil apiece. If any reader doubts this let him write to W. H. Underwood, of Hutchinson, Kansas, to verify it, as I do not vouch for the truth of the tale.

Mr. C. E. Mincer, of Hamburg, Iowa, circumvented the late frost of the spring of 1910 by placing oil and wood heaters through twelve acres of his orchard where his best trees were growing, when frost was predicted. He kept these at work for five days, and saved a crop of 6,000 bushels from his twelve acres.

A common plan is to build fires or smudges at frequent intervals through an orchard, thereby creating a dense cloud of smoke, which hangs over the orchard and blankets it. These fires may be made of

any suitable material that is at hand, or special orchard heaters may be purchased. Several makes are now on the market.

It is important that the fires be rather small in size and distributed at frequent intervals. This is because it is undesirable to create a heavy and strong draft such as a large fire gives rise to, since this draft will carry away to the upper atmosphere the heat and smoke that is needed next to the earth.

Some orchardists have followed the plan of using bags of manure to create a smudge. The manure is tightly packed into the bags and these are distributed through the orchard so as to be ready for use if needed. When frost threatens kerosene is poured on the bag and it is set on fire. It will burn slowly, giving off a dense smoke and adding moisture to the air, which will assist in forming an effective blanket.

Insect Pests and Diseases.

Three hundred million dollars is estimated to be the annual loss to this country from insect pests of various sorts. Yet out of seventy-five important insects, only two, the Colorado potato bug and the chinch bug, are native. The rest have been brought to this country in various ways, but chiefly on plants.

These insect pests are of two general classes—the chewing insects and the sucking ones. Chewing insects can be fought very easily by coating the foliage or any infected part with poison, such as paris green, london purple, etc. These contain arsenic, which the insect takes as it chews along the plant or leaf. Get on your poison early, when the foe is due to appear, and you will have little serious trouble. The main thing is to be on the ground first. But with the sucking insects you cannot leave your trap for them to fall into. It is a hand to hand battle.

In general it is safe to say that insect pests can be controlled in one way or another. But so long as there is plant life there will be insect life that will live on the plants. And new pests are continually coming up. We can hold these in check by constant vigilance, but we can't rout them utterly or exterminate them. The orchardist, especially, must make up his mind that to fight insect pests and fruit tree diseases is as much a part of his yearly program as it is to cultivate his orchard grounds, prune his trees, and pick his fruit harvests. Certainly he will have slim harvests to pick if he does not accept this hard fact and adapt his every twelve months of culture to that view, beginning with the first year of planting. Whether by arsenical spray, the oil solution, the lime-sulphur treatment, hand picking of bugs, cutting out infested parts and destroying them, or burning colonies or webs by lighted torches or poles, the battle is always going on somewhere.

San Jose Scale.

The San Jose scale is a sucking insect, and as it multiplies rapidly, it becomes a great drain on the fruit tree's vitality in a very short time. Growth stops perceptibly, the limbs begin to die at the tips, and unless spraying is immediately and thoroughly practiced the tree dies. Look carefully after the new growths or twigs to see if the

scale has made its appearance. If there is the slightest indication, spray with either the kerosene-soap solution or the lime-sulphur mixture. The soluble oils now on the market can be bought in readiness for solution in water. In fact, don't wait to look for the scale, as it is so small, only one-sixteenth of an inch in diameter, that it may not be discovered until too late. Spray anyhow, on the principle of the ounce of prevention. It is a good plan to do this while the trees are dormant.

The young scale insects can be destroyed by the kerosene emulsion before they secrete a scale. The lime-sulphur washes, used when the trees are dormant, will kill the adult scale, but as the kerosene emulsion must be used with great care, so that it comes in contact with each scale, the vigorous use of both sprays in the dormant season is specially advised. If you have only a few trees it is best to buy the stock solution of both oil and sulphur mixture. For a large orchard the lime-sulphur mixture may be made by the recipe which will be found below. Two sprayings are best—one early in the spring, before buds swell, and one in fall after leaves drop.

The small orchardist, however, is the man who is most apt to neglect the matter of spraying; and he is the one, therefore, who is most to be prodded up as to the absolute necessity for spraying for the San Jose scale. Fortunately this question is being made a matter of necessity and orchard owners are finding that they cannot continue to let even a few scale increase by lack of proper care and prevention. In California the scale is now practically exterminated, but it has spread to other localities, and it will soon be as much of a pest in the middle west and the east unless it is met with just as vigorous warfare as on the Pacific coast; where, beside the spraying method, entomologists set to work to find the native home of the insect, and then import its natural enemy from Australia—the ladybird bettle.

Spray Formulas.

Lime-sulphur solution. Small quantity:

Place five or six gallons of water in a large iron pot and heat it to the boiling point. Add twenty-two pounds of the best stone lime obtainable and seventeen pounds of sulphur made into a paste. Boil this mixture until it turns to a deep red color, which usually requires from three-quarters to an hour of rapid boiling. Keep stirring the solution all the time it is cooking, and when properly cooked add sufficient water to make fifty gallons in all. Strain it into the spray barrel and apply while hot.

Another recipe. Large quantities:

50 lbs. lime, 50 lbs. sulphur, 50 lbs. salt. Water enough to make 150 gallons of the wash. Boil this mixture an hour and a quarter, strain through three thicknesses of fine screen mosquito wire netting. Take the strainer off the bottom of the pump and wrap up this end of the pump with some kind of screen wire of four or five thicknesses. This will keep the pump from clogging with fine lime. Then use a nozzle with a hole about as large as the point of a lead pencil, not too small, and drench the trees well while in a dormant state. This wash

is cheap, and there is no danger to trees and buds if used at that period. The liquid can be applied warm or cold. The insects are killed as soon as the wash touches them, either by the burning of the caustic fluid or by closing up their breathing pores with the oil solution. The heavy ingredients also form a crust on the bark, preventing the normal development of the young insects. It is wise, while spraying, to keep at hand a quantity of grease free from salt, to use in case of personal accident from the lime-sulphur spray. Also grease the face, hands and inside of the gloves with this. The driver should be well protected and the horses blanketed. Use rubbers also and look out well for the face and hands.

Hibernating insects in fruit and ornamental trees may be treated by a carbolic and soap wash made of one pint crude carbolic acid, one quart of soft soap, and two gallons of hot water thoroughly mixed. Soda and whale oil soap wash is made in the proportion of five pounds of sal soda to five gallons of water, heated to a boil, and one quart of whale oil soap then added. Apply at about 120 degrees of temperature. A very simple treatment is a pound of washing soda to two pails of water. Where the trees have a rough bark, scrape first, either with a hoe, or a tree scraper. This removes the shaggy bark and the trunks and large branches can then be treated either by a wide brush or broom or the spray pump. Do this while they are in the dormant period.

Other Remedies and Preventions.

My method of preventive treatment for tree girdling by mice is to move back the mulching from the body of the trees from six to eight inches. If there should be a heavy fall of snow this could be banked up and trodded down hard. In case trees have already been girdled, bank them with earth as soon as possible, and when the grafting season comes on bridge over the girdled spots with cions such as are usually used in grafting, and cover again with banked earth. I have seen the strychnine method used for getting rid of both mice and rabbits, and corn kernels soaked in a solution of strychnine and water for twenty-four hours, scattering a few around each tree, are no doubt effectual. But as this method suggests other results than the killing of pests it might not be advisable to recommend it for general use. Probably the best method as a prevention for rabbits is to trap and snare them. Heavy building paper wrapped around the lower trunk to the height of eighteen inches and held in place by two ties of pliable wire will keep away mice; or a wire screen can be used. Rabbits do their worst work when the snow is deep and they can reach the branches.

Tar paper is not so good for tree protectors to keep mice and rabbits away as lighter colored paper. The dark color absorbs heat. Use light colored building paper, old newspapers, or burlap. Burn brush heaps and any old rubbish that will harbor rabbits and keep the orchard free from weeds. Live stock inside of the orchard in winter are worse than the rabbits, for they will eat the limbs. A thick whitewash is good to keep away both rabbits and borers.

Wire cloth 18 inches high makes a good protection for fruit trees. Dip it in oil before placing as a protection against rust through the winter.

However, the safest rabbit around fruit trees is a dead rabbit.

Blight in Pear and Apple Trees.

One remedy for blight in pear trees is said to have been found reliable after several years' experience. This is to cut all the dead limbs off, then with a sharp knife, score all the trees around deeply as high as can be reached from the ground.

The late Prof. Samuel B. Green wrote a brief summary once as to the cause of this disease in both pear and apple trees. I have given considerable space here to his article, which appeared in the N. W. Agriculturist a few years ago. Prof. Green said:

"Mr. Webber, of the U. S. Department of Agriculture, has made as careful a study of this subject as any one, and not long ago he presented his conclusions at a meeting of the American Pomological Society. At that time he claimed that he believed the trouble was caused by a disease, a special organism. This organism lived over in the wood, which was killed by the disease in the summer, and produced sticky spore masses which oozed out from the pustules in the diseased wood in the spring. Insects were attracted to it by its sweet taste and carried the spores on their feet, or other portions of their body, to the trees, and when these germs reached portions of the trees that were very susceptible, as on the new growth, or on the trunk where it is cracked, they soon started and grew into the tissue of the trees.

"In proof of this theory he showed that trees that were screened by a fine wire netting so that insects could not reach them were entirely exempt from blight, although they were kinds that were liable to this disease and were growing in orchards where all the other trees of the same kind were injured by it. In further proof of this he took the contents of the nectar carrying glands out of a honey bee that had been working near blighted trees and with the contents of these glands he inoculated healthy trees and produced the disease. But other insects besides honey bees also carry this disease. It seems to me that the case is pretty well made out in favor of the theory of this blight being produced by disease germs.

"The question of the treatment is the next point. It is probable that if it were possible to cover all the blighted tissue of apple trees with thick Bordeaux mixture the disease would not be spread by insects. It is found in practice, however, that little in the way of a prevention of this disease can come from the use of fungicides, and the most practical remedy seems to be to cut out and burn the diseased tissue some time during the summer. This removes the diseased wood and so leaves nothing for the production of spores to infect the orchard in the spring. I have personally seen very excellent results come from this treatment, where orchards were somewhat isolated and the infection could not come from near-by orchards that are uncared for.

"In this connection it should be noted that there is quite a differ-

ence in the immunity of different varieties to this disease, and we should aim to plant those that are most resistent to it. Then, too, we find that trees making an extremely rapid growth are more liable to it than those grown in a rather inferior soil, and this leads to the point that we should be careful about forcing a very rapid growth on our trees."

Lime and salt mixed with stable manure makes a good preventive of orchard blight. Mix separately: two to four quarts of the barrel salt to a load of manure, thoroughly mixed when taken from the stable. Then add one bushel of air-slacked lime to the load.

How Fruit Bearing Trees Should Be Pruned in the Northwest.

A very important consideration is not to cut off any limbs that act as a protection against sun scald on the trunk. Leave all limbs low as the fruit can be more easily reached. Trim out in the top and keep thin enough to let in the sun. Cut off all stubs and dead limbs. They are a menace to the living parts as they harbor disease and parasites. Cut the limb close to the main trunk or limb and paint to prevent rot.

Sun scald is the result of the action of the sun in winter on the side of the trunk of the tree exposed to the sun. When the sun is very warm some of the sap works up from the roots and then freezes there. Decomposition takes place and rot begins. This is very injurious to good fruit production although the tree itself may struggle along. It is always best to provide some protection against this in young trees, but by proper pruning of older trees the branches will act as a natural protection.

Sun Scald.

The last of winter is the time to guard against sun scald. If the tree heads low the limbs make sufficient protection from the dangers of the sun shining on one side of the frozen tree. Or if the trees leans to the south or southwest it is not liable to injury. But if erect, or it inclines north, the trunk is not sufficiently protected. In that case put a board on the south side, or building paper around the trunk, or a screen of straw and lath. These last also protect from mice and rabbits. Guards can also be made for this last purpose for small trees by using four staves of old barrels to a tree, and tie these with fine wire near the top, center and bottom. Such guards should be put on in November. Guards can also be made out of thin strips of elm wood about as thick as shingles and soaked for a little while in water. Make these eighteen inches long and twelve broad. Set around the tree in a circle and tie with fine wire at top, center and base. Cut the wire and bind with pincers.

Summary.

To summarize as to orchard growing for the beginner: Find out what fruit grows the best in your section and, if possible, travel around and look at successful orchards near your locality and learn the methods of their workers or owners.

Select a good piece of land with more than one direction of slope

and with a good drainage, unless you mean to raise only one species of fruit. Get your land in the very best shape for setting out trees, before you dig a hole, by deep plowing, heavy fertilizing and thorough cultivation. The soil for trees should be as finely worked as that for vegetables.

Prepare the holes for setting according to directions given here. In planting any tree, always let the strongest roots stand toward the prevailing winds, with the tree leaning a little in the same direction.

If you buy nursery stock, be sure it is the best, take it home carefully yourself and see that it is set out as rapidly as possible in the previously prepared holes.

If you try your own seedlings you must take more chances than with nursery stock. Follow the same method of transplanting, and you may or may not be tolerably successful. But do you really gain in the end? Fertilize, cultivate and mulch annually.

Prune annually.

Spray several times a year with regularity and efficiency.

When you start out to kill, be sure you do kill.

Study the best and improved methods every year. Gather, store and market your fruit so that it shall be first grade always. Get your reputation established and then keep it at that standard. By this method you will get your own standard and be able to reach favorable markets without the aid of any packing association. Have your own packing house, therefore, and your own style of individual package.

Last, and most important, be honest about every step of fruit growing. From start to finish don't think that big red apples on the top of the barrel will balance the poorer ones out of sight.

Hedge for a Fruit Orchard.

This hedge is for the farm, for a windbreak and for ornamenting around the buildings and gardens, having seven rows running parallel 12 feet apart. Trees set for a thick hedge must have room in order to get strong branches near the ground.. When small in the thick woods the tree grows tall and slender, and the lower branches where no sun shines on them die and decay. It should be remembered that the sun is life and strength in planting thick hedges. This hedge is not to be trimmed. Let it grow naturally. The first thing to be done is to prepare the ground for the hedge. Plow the ground very deep twice, late in summer or in August and September, and early in the spring, as soon as frost is gone, in order to get rid of the weeds and grass. Begin to cultivate immediately after planting. Always cultivate soon after a rain, as soon as the water is well settled and the ground is in good working condition. Where a horse cannot be used, stir the soil with a fork-spade from four to six inches deep. Cultivate the hedge yearly till it becomes so large and thick that it cannot be worked without injuring the bottom branches near the ground. Late in the fall, about the last of October, mulch the trees with hay, straw or coarse litter about ten to twelve inches deep and six to eight feet around the tree. Do not remove any mulching from the trees. The coming spring spade the mulching into the soil with a fork-spade. Trees for

this ornamental hedge should be Russian Golden Willow, Norway Spruce, Red Cedar, Colorado Blue Spruce, and American Arbor-Vitae. Plant all golden willows in the four outside rows; this will include four willow trees on the ends of the three center rows. The remainder of these three rows plant to evergreens, Colorado blue spruce and red cedar; American arbor vitae and Norway spruce.

Directions for Planting in the Hedge.

Dig the holes four feet across or in diameter and thirty inches deep; fill the hole nearly two-thirds full of good thick grass sod, lay them bottom side up and tramp them down tight. Put on top of these sods about four inches of good rich surface soil, place the tree in the hole about two inches deeper than it stood in the nursery, sift in good rich fine soil between the roots, using the fingers to spread out all the roots. When the roots are well covered give the tree a thorough soaking. As soon as the water is well settled around the roots, fill in more earth. Do not stamp the earth down solid. Give it more water and the soil around the roots will be well settled. All evergreens should be transplanted with a ball of dirt for safety. Evergreens should be watered every eight days in the evening, each tree with a thorough soaking, not sprinkling, for the first two years after planting, until the ground commences to freeze late in the fall. Evergreens must go into winter thoroughly soaked in order to winter and grow the coming season. It is not safe to depend on local showers to water evergreens in the northwest. Water and cultivation will cause evergreens to grow very fast in the northwest. It is injurious to squirt water on the foliage of evergreens with the hose, especially when the sun is shining hot.

The earth for about six feet around the tree should be dish-shaped. By having the earth dished a shower will soak in around the roots. When watering, place the hose two or three feet from the trunk of the tree flat on the ground. Let the water run as long as the soil will take it in, every eight days in the evening. As soon as the water is well settled and the ground is in good working condition a fork-spade should be used to stir the top soil. Otherwise a crust will form where the soil is all clay. Sand should be mixed into the clay, about one-fourth, for evergreens. The sand will prevent the soil from baking. Mixing the sand in it has a tendency to make the soil more porous around the roots, it will take in water more freely and the evergreens will grow much faster. A clay subsoil is all right, but when it comes up to the "second rail in the fence" it is all wrong. If the soil is all sand or gravel a bedding of clay should be put in the bottom of the hole to hold moisture.

The writer has been in several of the best fruit states and has been through several of the best counties in Minnesota for raising apples and small fruits, such as blackcap raspberries. I have seen patches on new land choppings where the trees were about one-half of them cut, the largest ones, and taken away. On these new cut-over lands I saw the finest patches of blackcap raspberries that I have ever seen; bearing immense crops of the largest and most beautiful berries.

Their winter protection was the scattering forest trees; their mulching was decayed forest leaves and rotted wood. I have also seen apples growing thrifty and bearing almost every year in among the oak groves. The owner said they were there when he bought the place, then several years old. He said that he had lived on this place fourteen years and they had borne fine apples almost every year. They were the Duchess and Wealthy. Finding such fine fruit growing so thriftily among those forest trees was the best of proof for fruit growing in the northwest, if it was protected from the cold, bleak wind. A farmer should have a large and thick hedge for a wind break on the prairies in the northwest to make fruit raising successful.

In regard to hedges every farmer should enclose from two to six acres, including all buildings, with a thick hedge, not only for fruit raising but for protection of barn yard. It is safer and better to enclose several acres for fruit. More air will circulate in a large place and the fruit is not so liable to be frosted by the late spring frosts. All fruit trees and berries should be planted inside of the hedge and thoroughly cultivated. This hedge can be planted to all willows or all English buckthorn or all evergreens. The willows and evergreens will look the best the year around, and make the closest and the most compact hedge. Three rows of white elms set diagonally twelve feet apart on the outside of this hedge would make it a very strong windbreak, or it can all be planted to upright ornamental trees, such as elms, linden and maple. White ash and elms are to be the trees if it is to be all ornamental upright trees. They will stand a very strong wind before breaking.

The farmers in the northwest should quit burning straw piles. Straw is too valuable to burn in such a wasteful way. On one occasion the writer transplanted about thirty sugar or rock maple; they were about three and a half inches in diameter. I cut them back a very little. They were transplanted about April 1, some fifteen years ago, in New York state, on a sandy, gravelly hill. I mulched them immediately after planting with about two tons of dry straw from 18 to 24 inches deep and from 8 to 10 feet around the trees. All of them lived and grew very fast. The rain was all the water they got. The most of them were tapped seven years ago to make sugar. At the present time they will measure 18 inches in diameter. Forest growing for protection is now desired by those who only a few years ago ridiculed it. Large quantities of mulching and cultivation will grow hedges and timber trees very fast in the northwest; white elms, white ash and linden and maples are the trees best adapted to this purpose. Neither soft nor hard well water should be used when first drawn from the well for watering trees and shrubbery. The water should be pumped into the tank and allowed to stand from eight to twelve hours before watering.

A Golden Willow Hedge For a Fruit Garden.

Enclose from three to six acres with a golden willow hedge. This is a very rapidly growing hedge. Plant from ten to twelve inches apart around the garden. In three years it will turn all stock. On the north

and west let it grow ten or twelve feet high to protect the garden from the cold winds. On the south and east it does not need to be so high. Cut back the first year, one-fourth of the new growth, about the first of September.

The bed can be prepared in the spring. With a plow measure off the piece of land you wish to enclose and then drive in stakes at each corner. Plow three furrows around the garden from five to ten inches deep. Then plant golden willow or buckthorn. They are both perfectly hardy. Be sure and keep them cut back and you will have a thicker and better hedge. Both of these are long-lived hedges.

Plant any windbreak from 75 to 100 feet from the fruit orchard, and plow deeply twice in the growing season along the windbreak on the inside, between the orchard and windbreak. This deep plowing will destroy the roots from the windbreak, so that they will not rob the orchard land of its food.

After planting, mulch thoroughly with stable manure and straw, for the first two years. The next thing is to plow and plant the fruit trees: From ten to fifty fall and winter apples, twenty of the Wealthy and ten of the Duchess of Oldenberg, twenty more of the next best apples. Whenever you see fine apples on the market, buy of them and save and plant the seed in your garden. Some of the best apples that are grown in this country are seedlings. The Tompkins Co., King's, and a number of others are seedlings. I would advise you to buy an apple by the name of Canada Reds. They are a beautiful red apple. I think they can be grown in the northwest from the seed. If you fail at first, try another. Plant twenty-five plums of about seven varieties. Then you will ensure some almost every year. The Cheney, Forest Garden, Wolf, Rockford, De Soto and Weaver are good. Plant twenty-four cherry trees of six varieties—four of each. Plant the trees in rows clear across the garden, twenty feet from the hedge and wide enough to drive a load of straw between the rows of full grown trees without breaking the limbs. Plant currants in rows; gooseberries in rows from four to six feet apart, so that this garden may be worked by a cultivator with a horse. Plant blackberries, raspberries—red and black, strawberries, grapes and rhubarb all in rows clear. If you have land to spare after you have put in the fruit and berries, then put in a nice lot of vegetables for the table.

Your straw will be worth $4.00 per ton on this garden and you will have no straw to burn by taking this course. You will have plenty of all kinds of fruit and berries and some to sell, and after the garden is once planted it will take but a trifle to keep it in good bearing shape the rest of your life, while you will have a good place to use all your straw and coarse manure. The willow hedge will make a great windbreak for your stock and building.

A farm with this garden is worth $2,000 more. The willow hedge can be put around a large piece of land very cheaply by using cuttings six or eight inches long. Make a good mellow bed for these. Plant in the spring, from the first of April to the 25th of May. Shove down

and leave about one-half an inch above ground. Mulch heavily with straw and coarse manure.

An orchard planted by the writer in the spring of 1911, on sandy loam, received the following treatment and made a great growth. There were 64 trees in all. After they were set out the land was dressed with horse manure at the rate of 100 loads per acre. The next spring this was plowed into the soil at a depth of from 6 to 8 inches and this was replowed every two weeks throughout the growing season. This treatment supplied plenty of plant food and the same time acted as a mulch for the retention of moisture.

CHAPTER XII

Trees and Farm Forestry

Who Plants a Tree.

He who plants a tree
Plants a hope,
Rootlets up through fibres blindly grope;
Leaves unfold into horizons free.
So man's life must climb
From the clods of time
Unto heavens sublime.
Canst thou prophesy, thou little tree,
What the glory of thy boughs shall be?

He who plants a tree
Plants a joy;
Plants a comfort that will never cloy
Every day a fresh reality.
Beautiful and strong,
To whose shelter throng
Creatures blithe with song.
If thou couldst but know, thou happy tree,
Of the bliss that shall inhabit thee!

He who plants a tree,
He plants peace.
Under its green curtain jargons cease,
Leaf and zephyr murmur soothingly;
Shadows soft with sleep
Down tired eyelids creep,
Balm of slumber deep.
Never hast thou dreamed, thou blessed tree,
Of the benediction thou shalt be.

He who plants a tree,
He plants love;
Tents of coolness spreading out above
Wayfarers he may not live to see.
Gifts that grow are best;
Hands that bless are blest.
Plant Life does the rest.
Heaven and earth help him who plants a tree,
And his work its own reward shall be.

—Lucy Larcom.

This new park is situated on a barren sand bar three feet deep or more. It contains eighty-six trees, of which forty-seven are pines and about forty white elms. The elms were planted in April and the white pines about the first of June. All of the trees made fine growth with very little watering, except the natural moisture. As soon as the trees were planted a mulching of straw sixteen inches deep was placed over the entire surface of the park, then a stable dressing three inches in depth was placed on top of the straw mulch.

Farm Forestry.

ONE of the most important features of the successful farm, small or large, is the growth and development of its trees. In this day, when so much attention is given to the problems of forestry, it is not necessary to dwell long on the commercial and farming advantages of tree growing as a business. It would be a good thing for the whole country if the government would foster tree planting among farmers either by appropriating money for premiums to the best tree growers of farming centers or by schools of forestry, such as those of Switzerland, where forestry work has been studied for years. So successful have they been there in protecting their fertile valleys from floods that students from all over the world go to their schools of forestry. England, likewise, has been taking up the same idea with such energy that 9,000,000 acres in Great Britain and Ireland have been set apart for this purpose for a period of 80 years. The royal commission estimates that these forests will be self-supporting in a generation, and that they will yield in time an income of about $37,000,000 annually.

Forestry is, therefore, a subject of vast importance in every part of the world. For, aside from a few cases of artificial advantages, the fertility of the soil and the needed conservation of moisture must be the criterion by which we judge the value of the land. The Bible tells us that "the tree is man's life." I firmly believe that where appropriations are made for drainage by our legislatures about ten times that amount should be at the same time appropriated for the planting of forest trees.

Too many sections of country, both in Europe and America, have been rendered useless for fruit or grain crops by the removal of the great primeval forests, thus curtailing the amount of rainfall and giving free sway for great evaporation through the hot winds of summer and through frost by the cold winds of spring.

This is particularly true in Italy and in the eastern and southern states of our own country. The wholesale destruction of the forests has been one of the causes of soil exhaustion, or of non-production. When the forests are cut away the soil on the high land is left without protection, and much of it is washed into the valleys, while the hills become sterile deserts. The men of this generation should rise up and stop this criminal destruction of forests, and thus protect not only themselves, but the coming generations.

Anyone whose farm is without timber should plant a portion of his acres in timber trees. After being cared for about three years this plot will take care of itself. In order that the farmer may get some idea of how more and more valuable timber is becoming, I quote from a somewhat recent article on the decay of our lumber trade:

"The forests of Michigan, Wisconsin and Minnesota originally contained a stand of about 350,000,000,000 feet. * * * Lumbering began in Michigan and Wisconsin during the thirties, and was of small importance until the early seventies. Since then the great pinery has been cut over in a way unprecedented in lumbering. In 1873 the cut was about 4,000,000,000 feet. It reached high water mark in 1892,

when it was over 8,500,000,000 feet. Since then it has steadily fallen, and in 1902 it was a little over 5,000,000,000. To the enormous total of about 188,000,000,000 feet cut in the last thirty years there must be added about 28,000,000,000 feet, or 15 per cent, for laths, shingles and minor produce, making a total of 216,000,000,000 feet. Fifty billion feet were probably cut prior to 1873, which would bring the total product to about 265,000,000,000 feet. It would seem then, that after the cut of 1902, exclusive of second growth, there were 85,000,000,000 feet standing. There are, however, by careful estimate, not more than 35,000,000,000 feet of merchantable timber, which also includes undoubtedly a considerable amount of second growth. Of the vast discrepancy only a part can be put down to error, since we know enough of the fire history of these states to ascribe the loss of 60,000,000,000 feet to fire. These figures show that it is a safe and conservative statement that the end of white pine is near, and that ten years will see it disappear as an important factor in the lumber trade.

"The present stand of yellow pine in the southern states is estimated to be about 137,000,000,000 feet. For the census year of 1900 the total cut of yellow pine was given as nearly 10,000,000,000 feet. These figures show that at the present rate of consumption the present stand of yellow pine will be exhausted long before a second crop can be produced to take its place."

Bringing these statistics down to the present we find that the consumption of yellow pine now amounts to about thirteen billion feet; that most of this comes from the south and the state of Washington; that about twenty-seven billion feet of other lumber was cut in 1909; that Douglas fir has risen to second place and white pine fallen to third place in point of production; that the supply of white oak for railroad ties is decreasing so fast that cheaper and more plentiful woods are being seasoned and treated for that purpose, the lodgepole pine of the northwest being one variety. The same is true of the manufacture of pulpwood. In this case scrub pine, white fir and inferior woods are now employed.

Value of Tree Planting.

The fact that the government has just received damages from a railroad for young forest growth burned in the Black Hills National Forest is another sign of the growing interest in the protection of forest reproduction. There are yield tables now being prepared by which the time necessary to produce a merchantable crop of given timber per acre, and its comparative value during growth, can be estimated for purposes of sale, condemnation or damage claims. These tables will be accessible to all farmers, and every man who contemplates forestry to any degree should avail himself of them.

The natural inference from all these statistics is that as a commercial investment the planting, preservation and cultivation of the hardier native trees that are disappearing so rapidly is to be one of the problems of the farmers of this and the next generation. It is not a get-rich-quick labor, but every year that it is done on farms adds greatly to their value.

JAPANESE TREE LILAC PLANTED BY E. J. GRINNELL.

This is a very hardy species of Lilac and grows in the form of a tree. It does not bush out at the root.

As a general law it may be said that no matter what the moisture conditions of a locality may be, tree planting will greatly improve the value of farming lands. If you can grow anything on a soil you can grow a tree there. When once you have grown the trees, far-reaching and beneficial changes in your crops and fields will result. In dry countries, where hot winds prevail such as western Kansas, some parts of Colorado and Nebraska, and northern Oklahoma, they have already derived great benefit from the planting of windbreaks and shelter belts, which were planted by the advice of the Forestry Service.

The same has been long true of the Dakotas, where tree plantations have helped the farmers in the development of even their rich lands. The forestry bureau is authority for the statement that the strips of land that farmers in Illinois might divert from agriculture, in creating shelter belts, would be put to better use than if continued in crops, because the remainder of the land would be so much benefited by the change.

Before planting trees for forestry purposes the land should be enriched with a heavy dressing of stable manure, straw or any good top dressing and plowed under.

The spring, of course, is the best time for planting. The trees should be set in straight rows, six feet apart. In order to give them a good start they should be carefully cultivated for two or three years. During the third year (after planting) those to be used for timber should be closely trimmed, leaving only a very small top. Leave all brush on the ground to hold the leaves. There should be some rows planted ten feet apart, so that a wagon loaded with straw may drive in. Using it for mulching would make the straw piles much more valuable than to burn them.

Methods of Tree Planting.

Plant small trees and cultivate thoroughly. Elm trees and almost all kinds of trees can be grown to a large size in a few years by heavily manuring or mulching and cultivating. Trees will grow in one year with this treatment as much as they will in six years in sod, thick grass or weeds without fertilizing and steady cultivation of the soil.

The more the ground is stirred the greater will be its moisture content. A large quantity of straw or hay manure put a little distance from the trunk or main stem will give an excellent sort of mulch. Stock should be kept away from tree plantations.

Elms, hard and soft maples, green ash, lindens and other trees can be grown in gravel or sand with rains alone serving as moisture, if the following method of planting is followed:

For one to three-inch trees dig round holes three feet deep and four feet in diameter. For somewhat larger trees six to eight feet in depth and the same in diameter. In preparing the smaller hole put in one foot of clay and one foot of good black earth above clay. Pulverize this well and set the tree on it, keeping the roots spread out. Then fill in around the roots very closely with the best of rich soil, carrying

this layer up to within six inches of the top. Finish to the surface by a layer of well rotted manure and over this spread a rounded cover of good black dirt. If the roots are good and have not been exposed to the air for a moment, and the tops have been cut back closely before planting, trees set out by this method and thoroughly cultivated with the fork-spade once a month, will make sure and rapid growth even in a sandy soil.

Another variation of this method is to put layers of grass sods upside down in the bottom of the holes from a foot to eighteen inches deep, after the clay soil has been put in. Heavy grass sods are excellent fertilizers and great moisture holders. Wherever extra watering is necessary it should be applied from four to six feet from the trunk and allowed to soak through the soil. If the moisture is applied too close the soil bakes there and roots will not thrive with dry, hard soil at the base of either tree or shrub.

Aim to establish forest conditions as rapidly as possible. Set thickly on thoroughly tilled soil. Such planting gives shade rapidly and thus controls weeds and grass, and if located on the south, west and north of buildings and fruit and vegetable gardens greatly aids in their profit. Thick planting, however, is nature's method for efficiency, and insures straight stocks, free from lateral limbs.

The Elm Tree.

I should plant ninety-nine white elms to every hundred trees I planted, and the one hundredth would often be an elm. The hard maple is a desirable tree. The elm tree, however, as a windbreak for the northwestern states is unsurpassed. It is easily transplanted, grows fast, is hardy, long-lived, tough, yet elastic in fibre, and therefore less likely to split off at forks or break off limbs in wind storms. As a timber tree it is not of so much value, but for decorative or street purposes or in long lines of protection it is superb.

A writer in one of the western agricultural papers said not long ago:

"I have one of these trees which I brought in a wagon thirty miles, about thirty-seven years ago, and planted with my own hands, that measures six feet and eight inches in circumference a foot above the ground, is sixty feet high and has a sweep of limbs of fifty feet. To my wife and me that tree seems almost like one of our children—and the best of it all is that it stays at home."

Planting for Shade and Ornament.

When planting for shade purposes, holes for medium-sized trees should be three feet deep and four feet wide each way. Put from twelve to fourteen inches of well rotted manure in the bottom. This covered by a light covering of good black soil will make a good foundation. Upon this set the tree, arranging the roots carefully, after well treading down this subsoil. A layer of black dirt is then filled in to about ten inches of the top. Coarse stable dressing upon this to fill up to the surface level. Above this, cover with earth well banked for a radius of about two feet and four inches above the natural sur-

Illustration of ornamental shade trees on residence lot at Hamline, Minn. These trees were planted in coarse gravel. Note what scientific planting has done for them.

face. Cultivate often around the tree for the first year and mulch heavily with manure the second year, then cover again with dirt.

Among our desirable native trees of the Northwest, the common wild black cherry, as also the red cherry, which last has a finely colored stem and limbs, make excellent ornamental trees. The black cherry grows about as rapidly as the white ash, and one variety has a graceful weeping habit of growth. The tent caterpilar is the greatest pest to this tree, but these can be controlled by care. The honey locust is also a hardy grower up to the northern line of Iowa. If possible get the kind that bears no pods. All these trees will grow from the seeds, if given the usual garden culture. The American linden, or basswood, if raised from seed and planted singly, makes a desirable and fine shade tree. The Buckeye, a variety of chestnut tree which does not blossom, is still a beautiful tree. This also grows at present as far north as northern Iowa, and could probably be made hardier by selection.

Mr. Emmans' Grove.

(A Personal Letter.)

In response to the numerous inquiries as to the history or origin of my grove of elm trees, located at the corner of James and Douglas Avenues, in Green's Addition, Minneapolis, I would say, I have never done anything that has given me greater results, considering the time and money spent, or that has returned me so much public admiration as my little nursery. In substance, I had a double corner, 100x135 feet, diagonally across the street from my residence, that I didn't care to dispose of at present; therefore, I thought I would set it out in shade trees. In the spring of 1899 I went to Lake Harriet and purchased of the Park Board, out of their nursery, little elm trees about 2 inches in diameter, and set them out in rows, 10 feet apart each way. I watered and cultivated them several times during the early season of 1899 and 1900, and have done nothing with them since and today they speak for themselves. In the ten years that they have been set out they have grown until many of them will measure from 10 to 12 inches through. They cost me in the spring of '99, $1.25 each, set out, and today they are worth on the ground standing, form $15 to $40 each. If the above be true, please inform me of an easier or quicker way of making money.

N. H. Emmans.

Mr. Emmans' grove of elm trees is a marvel, considering the short time they have been planted. I have seen many trees planted in the southern states, but this grove surpasses them all for rapid growth and is proof that timber can be grown very rapidly in the northwest if it is given the right cultivation. Elms should be planted ten feet apart. At a low estimate over ten thousand trees can be grown on ten acres. After six years of growth each tree would bring five dollars, making the ten acres worth twenty thousand dollars, if all the trees were sold. From this snapshot estimate a fair idea as to the real value of farm forestry can be gathered, for there are many trees not so slow growing as elms which will be just as valuable for crop

protection, farm repairs, fuel for the home, and an annual cut for market purposes.

RAPIDITY OF GROWTH OF TREES.

Beginning with a three-inch sapling the following named varieties of trees will, in twenty years, under favorable conditions, attain a diameter approximately as follows:

	Inches.
White or Silver Maple	21
American White Elm	19
Basswood	17
Red Maple	16
Yellow Locust	14
Box Elder	14
Hard Maple	13
Red Oak	13
Scarlet Oak	13
White Ash	12
White Oak	11
Hackberry	10

With plenty of cultivation and straw mulching the growth of trees in this list will surpass the figures given.

Trees for the Northwest.

Plant trees for forestry purposes in the northwest that are adapted to the climate. Among these the white elm heads the list, as it grows rapidly and is long lived. Soft maple and box elder grow well, but the winds are apt to be destructive to them. The green ash is hardy, but is a very slow grower. Some varieties of pine will grow. These, however, are not advisable for wood or timber, but make good windbreaks, especially the tamarack, cedar and balsam.

Plant a good grove of from ten to twenty acres, and apply all your surplus straw and manure to that timber land. No stock should be allowed to run in this timber. By this method of forestry the farmers of the country can have plenty of wood and timber. Remember, however, that trees planted for timber or sawing lumber must be trimmed when very small to get rid of the knots high up on the trunk or body.

Trees are a good deal like grain in that that they can be made to grow slowly and yet live and thrive. Or they can be so started and encouraged that they will grow rapidly. The farmer who can develop a good stand of timber the quickest has so much more capital to reckon on each year, and in twenty-five years even the slower growing trees will be marketable for building purposes.

The hardy catalpa may be grown in a generation at a great profit. A Nebraska man says he set out twenty acres of one year old catalpas in 1889, first putting the ground in a thorough state of cultivation. For two years he kept up the cultivation, and after that gave no further care, except to prune a portion and furnish needed protection

ORNAMENTAL SHADE TREES PLANTED BY E. J. GRINNELL.

In this group are White Elm and Lindens, the latter often called Basswood. These are the longest-lived trees that are growu in a temperate climate. The linden blossoms make the best honey.

against fire and tramp live stock. In 1906 he harvested the crop, selling over four thousand dollars worth of posts and poles, and over a thousand dollars of cord wood. He figured that his investment had realized him $152.07 per acre, while from his old stumps he planned to harvest a second crop in about ten years. If the trees had been set 8 ft. instead of 4 ft. apart they would have yielded larger posts in the 16 years by selling off alternate trees when 8 years old.

In a northern climate, however, the catalpa is not hardy, unless grown from northern seed. They will winter-kill more or less. Where the temperature is milder and the soil fertile the catalpa grows easily. If they are planted in rows and cultivated after the method of the afore mentioned catalpa grower, they will soon prove of commercial value.

The staunch oak outranks any tree that is used for timber, both for its beauty of grain and durability. Whether the white, the red or the black variety is grown, they can all be cultivated for forestry purposes by planting the acorns in the fall in rows wide enough to cultivate as you would a field of corn or any other cultivated crop. The oak is a slow grower, and marketable results cannot be expected for many years. Oaks can stand both extreme heat and cold, but of late years the borer has ravaged them in some localities. The beautiful chestnut trees of the east have also suffered greatly from disease in recent seasons.

Prompt and effective attention is the only thing that will save trees when they have been once infected by disease or insects.

Any farmer planning to devote several acres of his land to forestry would do well to write to the Chief Forester, Department of Agriculture, at Washington, D. C., and inquire if a free forestry station cannot be established on his farm. If consent is had to this he will probably get some valuable advice suited to his own section.

The Care of a Woodlot.

From "Garden and Farm Almanac"

Woodlots differ enormously in the kinds of trees which compose them. They vary greatly, too, from changes in the forest resulting from outside causes, of which fire and cutting are the most important. You obviously cannot manage successfully a New England woodlot of beech, birch, and maple under the methods required for a mixture of yellow poplar and other southern hardwoods in the Appalachian region. But certain practical principles of forest management hold good for all woodlots; it is their local application only that varies. Printed suggestions are not alone enough to point the way to the best management of your individual forest problem effectively.

Woodlots fall into several great classes as regards the character and condition of the forest growth and corresponding treatment necessary. The common type is that in which trees varying widely in age are growing together. Uneven-aged woodlots usually contain several kinds of trees, and they occur only where natural forest conditions have not been greatly disturbed by cutting or fire. When the original forest has been materially changed the stand is sometimes approxi-

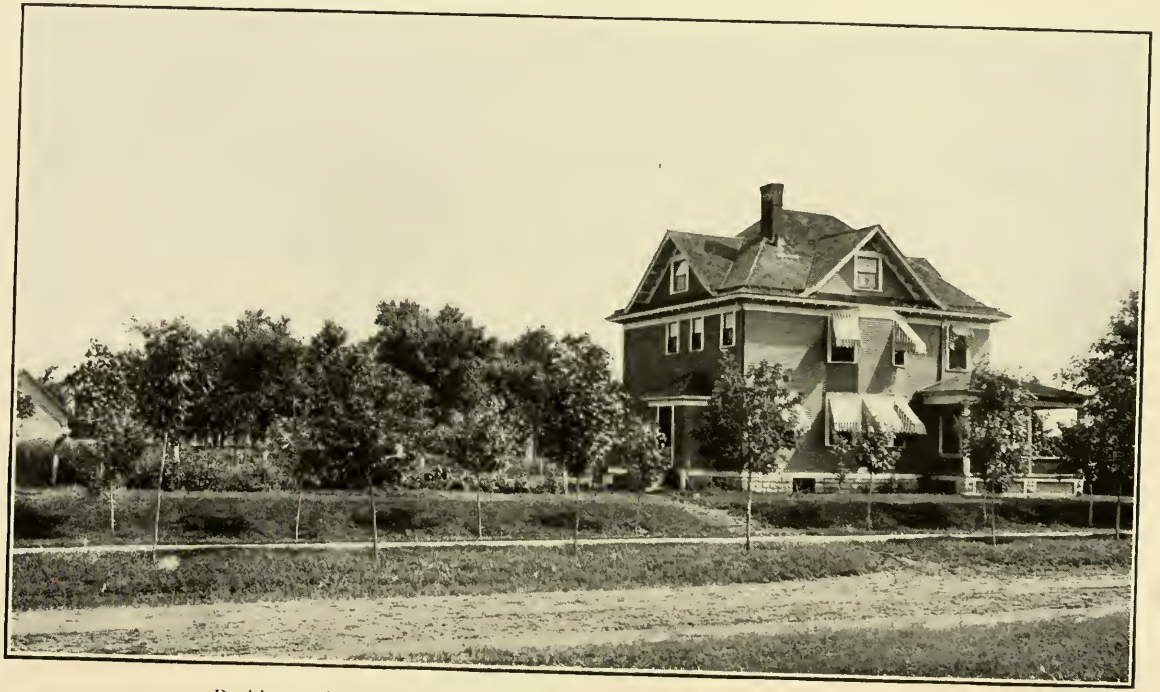
mately even-aged, all the trees being of about the same size. This is characteristic of second growth either from seed or from stump shoots, on cut over land. In some woodlots the trees fall into two or more, but usually two, distinct classes of age and size. Those two-storied forests are often caused by the mixture of two species, one relatively tolerant and the other intolerant of shade. An underwood of hemlock is frequently found among white pine, or a growth of balsam under an upper story of spruce for just this reason. Again the woodlot is sometimes composed of scattered large trees, in which young growth, as the result of fire, over cutting or grazing, or a combination of these causes, is entirely absent.

In the uneven-aged woodlot, exceedingly careful cuttings are necessary. The varied mixture of trees of different kinds and sizes does not present a problem which can be met throughout by the uniform method of cutting advisable in an even-aged stand. Each group of trees offers a new problem. But the uneven-aged woodlot is generally in urgent need of what are called improvement cuttings. These are aimed directly both at harvesting the mature timber and at improving the general condition of the forest. Improvement cuttings, in order to be most effective, have generally to be made by a process of individual selection of trees which ought to come out. If you cut all trees of a certain kind and size in such a forest within hard and fast limits some parts of it would be opened up too severely, while in others even a heavier cutting would be necessary. But you can greatly improve its condition by making your cuttings conform to the following general rules:

Cut, first of all, unsound, unpromising or badly shaped trees of all kinds for which you have use or can find a market. Be content to harvest some of them even if there is little profit in it. It will pay in the improvement of the forest. This is the first and most important step which is essential in order to put your woodlot in condition to produce. If you leave these over mature and failing trees uncut they will eat up in decay what the thrifty trees are gaining. It is for exactly this reason that the virgin forest is practically unproductive. It merely holds its own because what should be used goes to waste.

Another important consideration in your cuttings is to encourage promising young growth by cutting out old trees which retard it. Don't let branchy old trees, even of valuable kinds, check the growth of thrifty saplings. Nature provides for that in the course of time by the death of the old trees. But you can assist nature by removing them promptly and at the same time harvest material which would otherwise go to waste. If you wait too long the saplings will be dwarfed or malformed and will fail to respond to the increased light which the cutting gives. The larger the young growth, the more difficut it is to fell the old trees without injuring it.

Observation in your woodlot will soon show you which trees grow fastest. It will teach you a great deal about how they compare in demands upon light and upon soil. Use this knowledge in making your cuttings. Encourage the fastest growing trees if their value justifies it. Don't cut out the old trees over shade-enduring young



Residence of H. W. Rice, Hamline, Minn. Originally bare of any foliage.
Transformed in a period of three years. Planted by the author.

growth—maple or white pine for instance—with as heavy a hand as if the young growth required much more light, as in the case of birch or yellow poplar. Encourage the growth of trees in those localities which they prefer. Go easy with the axe on dry southern slopes and on shallow rocky soils. Make entirely sure that there is young growth coming on to take the place of the trees you cut out. It is exceedingly hard to get trees back upon such unfavorable localities if you handicap them by over cutting. If you are in doubt whether a tree should come out leave it standing. The harm resulting from cutting too little is much easier to remedy than from cutting too much. You can cure the former with the axe, whenever the need arises; the latter takes many years to cure. If the improvement cutting lets in too much light the remaining trees freed from shade at the side, will grow branchy instead of putting on height growth. That is why in dense stands the trees are tall and clean of branches while in open stands height growth falls off and the trees are branched almost to the ground. Another bad result of too heavy an improvement cutting is the drying out of the soil through its exposure to sun and wind, which not only lessens its value for tree growth, but also makes it exceedingly difficult or even impossible for seedlings to spring up from it. This is particularly true when the cutting is sufficiently heavy to invite a growth of grass and weeds. In regular woods it is generally both practicable and advisable to make so-called improvement cuttings entirely separate from cuttings intended to invite reproduction or, in other words, to create conditions favorable to the germination of self-sown seed and the growth of seedlings. But in irregular woods, whose conditions closely resemble those of the virgin forest, the improvement cutting generally has to serve as a reproduction cutting as well. This means that the closest attention must be given not only to removing unprofitable trees, either on account of their kind, quality or position in the forest, but also to the effect of their removal upon the forest of the future. For example, it would be a mistake to cut all the seed-bearing ash in your woodlot simply because they are ripe, if there were not enough young ash already established to make sure the species would hold its own in the mixture. It would be far better to leave some of the old ash standing for a few years, to act as seed trees. Remember always that every mature tree you cut means a material change in the balance of power in your woodlot, so far as the young growth to come is concerned. Cut cautiously in inviting reproduction. An ill-considered cutting may so reduce the seed-bearing trees of a valuable species that it will be practically absent from the second growth which follows. Again, too heavy a cutting in a mixed forest often enables a valueless species to take possession of the ground, as a result of change in the amount of light admitted to the soil. If you remember that you can't change nature in the uneven-aged woodlot—you can merely assist her—you will not go far wrong.

What the farmer can sometimes do with his own timber may be seen from the story which comes from Elma, Washington. Elma is in the midst of the great fir timber belt on the western slope of the

Cascade mountains. Near here was found a giant Douglas fir, very straight. When scaled it was found to contain 40,000 feet of serviceable lumber.

The tree was cut into six logs, the first or butt being twenty-eight feet in length. Inside the bark the stump measured seven feet and nine inches in diameter. The distance to the first limb of this tree was 100 feet, and the total height of the tree was over 300 feet.

At the standard price of $25 a thousand the lumber was worth more than $1,000.

From this one tree was built a fourteen-room, two story and a half house.

To Summarize As To Farm Forestry.

1. Decide whether you will plant your woodlot as a separate division of the farm, or as shelter belts, extending as much as possible around the farm and as wide as possible.

2. Get information from the Bureau of Forestry as to the trees best suited to your own locality. This department has a practical handbook on this subject.

3. If possible, enrich and cultivate by plowing the plot or plots intended for forestry.

4. Use continual cultivation with a fork spade once a month for about three years, from four to six feet around the young trees through the growing season. Late in the fall mulch heavily and early in the spring use additional fertilizing.

5. Prune and thin out for commercial or farm purposes as fast as the trees develop.

The states should make appropriations to encourage the growth of trees, by premiums for the most successful results. In Switzerland, as I have said, the methods adopted by the government have a high reputation, and the schools of forestry are sought by students from all over the world. Get the children of the farms of the United States interested in the work. Give prizes of land—not less than an acre—to the children who have the best success in growing the native trees of their locality. Let the departments of agriculture of each state furnish tested seed or seedlings for this purpose and encourage the work by scientific supervision. This would not only be an incentive to the greater interest of farm children in farm life and its results, but it would impress upon them the great lesson that pruning and training are the best for all growing things and that nothing living ever gets too old to be disciplined.

Trees, Planting of Shrubbery.

When planting trees and shrubbery of any kind, always dig deep holes having large diameter with a good circumference so that the tree and shrub will have room to retain plenty of moisture. In the hole before the planting place about four inches of old well rotted manure, tread it down good to the bottom of the hole, then place three inches of good black soil on this, then another layer of old well rotted barnyard manure three inches thick, then place two inches of black soil. Then set the trees or shrubbery of any kind, and fill in around

the roots with the best of soil, leaving sufficient room for moisture from rain, etc. Then mulch from ten to twelve inches deep. Trees and shrubbery planted in this way will grow rapidly and will retain the moisture in a case of long drouth.

Very often in early spring the ground around the trees is found hard and dry so the cultivation should be started then and continued throughout the entire season. Should the spring moisture be lost by starting late to cultivate, it cannot be retained again that season, consequently the plants cannot do so well as in early cultivation. This method of planting trees and shrubbery has proven a great success wherever it has been tested. This is also true of fruit orchards with all kinds of fruit trees. The cultivation should continue through the entire season until late in the autumn. This will retain the moisture and the buds will set. This is true of all kinds of trees and shrubbery. The cultivation should continue until very late in the autumn.

The season of 1910 was a very hard one for the northwest. There were no good rains and very few and light local showers. In the spring of that year I transplanted a number of large ornamental shade trees (white elm and lindens). They measured from 6 to 7 inches in diameter and I retained their natural full top or head. They were dug with a ball of earth which was wrapped in burlap tightly to hold it. The subsoil into which they had to be placed was light sand so I had them dug deeper than usual and had heavy clay hauled a distance of four miles. Put one load in each hole and made it basin shaped so as to retain moisture. The trees not only lived but made a great growth during a season that proved a severe test for most trees.

The hardwood timber needs a stronger soil than the soft varieties, so ordinarily a tract of land that supports for instance white oak trees is considered very good agricultural land.

The climate of course has a lot to do with the size of trees. Warm localities produce the largest trees provided soil conditions are right. Thus California produces her giant Redwood trees and Oregon and Washington the enormous fir trees. On the other hand in localities where the winters are long and cold, the forest trees are very apt to be dwarfed and often cracked from freezing. Thus the trees with least sap are more adapted to these regions. The elm, green ash and most varieties of evergreens are in this class. The maples, box elders and others containing a large quantity of sap are not so hardy for extremely cold locations.

A tree which is only two inches in diameter, that has grown wild in the natural forest or thicket oftentimes may be from twenty to thirty years old.

A nursery-grown tree of the same size would be only eight years old. The latter is a much hardier tree and less liable to attacks by insects and disease because it has a complete system of fiberous roots which are lacking in the forest-grown tree.

CHAPTER XIII

Evergreens

THERE seems to be a general impression among farmers and home builders of all localities that evergreens are hard to grow successfully. And while riding through country districts the number of dead evergreens one sees in many home grounds, only strengthens belief that this idea is general. But is this not because the average person does not know with what ease evergreens adapt themselves to surroundings and take firm hold on the soil if they are given the right care from the start?

The cone bearing evergreens that are native to the northwest give the farmer or the landscape gardener some of the rarest species of ornamental trees, lending as they do, color to the winter landscape when other tree foliage is gone. Carefully handled, they can be transplanted as well as any other tree.

One row of evergreens, it has been said, will protect from wind, as well as several rows of deciduous trees. Both spruce and pine are sure to grow if they are not already dead at the root when set out. Get your plants from a reliable nursery house as near your home as possible. Don't expose the roots to the air for a moment. Get small seedling trees, if you can afford it, rather than try the seeds yourself. They pay especial attention in nurseries to the treatment of the root system with a view to transplanting and you will probably gain two years of growth by a very small outlay of money.

A good method for planting these trees is to use swamp moss. Dig the holes the same as for other shade trees, then place this swamp moss from four to six inches thick on the roots of these trees, then cover thoroughly with good soil and mulch on top again about three inches deep with rotted wet hay or straw. When this is thoroughly wet it holds the moisture for a long period of time and seldom ever dries out. Ninety-nine per cent of trees planted in this way will thrive and grow very rapidly, and the foilage will be rich and plentiful.

Set these seedling trees out in nursery rows about five feet apart and three feet apart in the row. This enables the cultivation of the rows in the summer. It is not best to set small evergreens after September. Cultivate frequently. Keep from severe drought by watering, and mulch thoroughly. If you can, bring your plants from the nursery yourself, have the holes ready for immediate planting, follow the directions for planting given in this chapter, and cultivate and mulch for three or four years thereafter. In ten years you will have a windbreak that will save you ten per cent on the money invested, and add at least that much to your farm's value.

Planted by E. J. Grinnell in the Spring of 1905. These trees when planted were 3½ feet high and in 7 years reached a height of 24 feet. The trees shown at either side are Colorado Blues and in the Center a Douglas Spruce.

I repeat again that evergreens can be grown on all soils by cultivation. Though the natural home of the evergreen is in deep rich bottom soils, in swamps where the fertility has been washed in for centuries and centuries, yet the writer's experience in removing and cultivating all kinds of evergreens convinces him that the right cultivation can make almost any evergreen grow. Old, well rotted manure, well spaded in the first year with a fork-spade, and this treatment continued for five or six years, will promote growth and foliage of a bright glossy green velvet color. As one evergreen culturist says:

"What a wonderful revolution there would be in the climate of our northern states if every section line could be marked by a belt of evergreens, 75 feet high. The sweep of winds across the bleak prairies would be so arrested and broken that we believe that the snow in a large share of the country would lie comparatively level through the winter. The winter rides along our highways would be calm and comfortable to a wonderful degree. The troubled winds that in haying and harvest, and at other times, almost stop some classes of farm work, would be greatly lessened, or almost unknown. Drying winds that curl the corn and destroy other crops would almost disappear, and how interesting the country would appear with its long lines of green, both winter and summer."

Varieties.

The best and hardiest evergreen for the northwest is the Colorado blue spruce. There are three or four varieties of this species, but all are from the same family. They vary from the richest green and blue green to a dark silver blue, the latter fading the least in the sun. It is a native of the Rocky mountains, where it is found among the upper snows, and its hardiness to withstand cold, heat, drouths and floods is well established. Next to this evergreen, I would place the Douglas fir and the white spruce for hardy qualities.

For hedges the American arbor vitae and the arbor vitae pyramidalis are excellent northwestern growers. The foliage of the American arbor vitae being finely cut and very dense, it is especially good for ornamental hedges. When once established it grows rapidly and, all things considered, it is perhaps the best known and most popular evergreen in cultivation, either for single specimens on a lawn, planted in clumps, or as a hedge for use or ornament.

Arbor vitae pyramidalis, as its name shows, grows symmetrically in slender pyramid-shaped heads of dark green. Being very hardy and vigorous in growth, it also is a favorite evergreen.

When To Transplant and How.

The best time to transplant the Colorado blue spruce is from May 12 to May 28 or June 10. Trees of this variety, it is well known, can be safely transplanted in all sizes, if the following directions are carefully observed:

First bandage in the branches closely with good strong burlap. Then dig around the roots in a circle whose circumference increases with the size of the tree, as you must be sure that you will include

enough soil to save all the roots. For trees 3 feet in height leave an earth ball of 30 inches in diameter on the roots and shaped about like a hen's egg. Dig down from 2 to 3 feet before bandaging this root ball. Bandage this ball before tipping the tree, using stout burlap, so that no dirt will escape, and sew the burlap firmly with strong binding twine. Before turning the tree over loosen the dirt ball at the bottom with a spading-fork, or cut with a sharp shovel-spade. This insures the final removal of the under roots without losing the soil ball. Replant the same day that the trees are dug, in good mellow soil, with all grass or weeds removed within a circle of from 6 to 8 feet. Leave on the burlap root bandage when planted, but before putting the last two or three shovels of dirt around the tree cut open the top of the bandage so that the water can go down freely around the roots. Use water very thoroughly after planting.

Spade well and in a large circle around the trees every two weeks, from 4 to 6 inches deep—even deeper in dry weather—until the first of September. Remember that cultivation is the life of all trees, and especially of evergreens, which require a great deal of moisture. Spade before it rains and after showers, in order to make use of all natural moisture, and if all mulching is spaded in with the fork-spade the showers will go down deeper into the soil.

In transplanting large evergreens allow them to branch freely near the ground, as this keeps moisture in the soil, as well as makes the tree more symmetrical. Never turn the hose on the foliage when watering, nor when cold. The reason why so many evergreens fail in the northwest is that they are not given plenty of water in the latter part of the season. They froze up in dry soil. If the rainfall is light late in the fall the soil should be thoroughly soaked every day until winter sets in.

Seedling Evergreens.

Seedling evergreens are those that have not been transplanted. I often hear people say that they cannot get seedling evergreens to grow. But the great secret of transplanting and growing seedling evergreens successfully is to keep the roots moist perpetually from the time they are taken out of the soil until they are safely planted in the home grounds. This care begins before the seedling is dug by preparing a deep puddle of mud, clay preferably, two or three feet deep, in which to place the tree, standing, the moment it is taken from the soil. The mud should be quite thick, so that the roots will be thoroughly covered. When ready to lift from the mud bath wrap the roots of each tree separately with wet moss or fine hay. Then burlap. Transplant just as the buds are swelling. If moved too early the buds often dry. If too late they break easily.

All kinds of young and small evergreens planted where exposed to sun and wind should have shades placed around them. Take oak brush, or some young oaks from three to four feet high with the leaves all on them, and stick these down about six inches in the ground and from eighteen to twenty-four inches from the trees. Put these in a circle, with the brush leaning towards the evergreens. They must be so placed that they will shade from the bright winter sun, and be

left until settled spring weather. This is also a good protection against dogs. Be sure that the brush is set deep enough in the ground to withstand high winds. If small trees are planted and not seedling evergreens, transplant these later into nursery rows near a board fence or a row of trees that form a windbreak. For a new country red cedar or Scotch pine are good, but jack pines and other northern grown evergreens grow well if protected.

Plant Away From Windows.

To set evergreens opposite large glass windows on the southeast and southwest sides of buildings is dangerous in zero climates. The writer planted 29 red cedar trees 3½ feet high on the west side of a two-story building with large glass windows. All the trees lived and made a good growth the first season. The next spring two of those trees planted from 8 to 9 feet distance opposite the large windows died from top to bottom. The reflection of the sun on the large expanse of glass was the cause.

Evergreens in zero climates should be planted from 16 to 20 feet from windows, on the southeast and southwest. I have seen groves of cedars and Colorado spruce from 8 to 12 feet high on the east side, when the foliage on the southeast and southwest was dead and burnt by reflection of the bright sun coming in contact with the zero frosted panes.

Evergreens that have been grown in the shade of trees should be shaded at first when transplanted; in fact, make the new abode of the tree as much like the old as possible. In thirty-five years' experience with evergreens I find those that have been partly shaded summer and winter with tall forest trees are brighter and richer colored. The extreme cold of winter nights and the bright suns of hot summer days fade the foliage and weaken the vigor of the evergreen. A few forest trees planted on the southwest from 16 to 20 feet from the evergreens and planted in a triangle will partially protect the evergreens.

Sweep Up the Snow.

The first snows that fall in the fore part of winter should be swept up around the evergreens and tender shrubbery from two to four feet deep. Do this with a heavy barn broom and sift the snow all through and over the branches when it is soft and loose. By sweeping it in several feet deep it will settle very close around the evergreens and shrubs. The first snowfall can be kept from melting if banked up deep and covered with straw from 4 to 6 inches deep over the snow. The bright winter sun will not melt the snows until late in the spring. Often in cold climates, where the days are mostly clear, the snows go before any spring rains come, and the ground is often frozen so hard and deep that the snow water is lost. Sweeping up the first snows keeps the hard frost out of the ground around the trees and shrubs, and when this snow melts in spring the trees and shrubs get the water that sinks into the ground under the mulching.

Using Tackles.

Tackles should be used for transplanting large trees. Cut back from one-third to one-half on all trees except evergreens. Leave all evergreens full top. One of the best ways for trees from 4 to 6 inches in diameter is to dig a trench about 2 feet each way from the tree and from 3 to 4 feet deep, according to the depth of the roots. Do this late in the fall, and be sure to secure a ball of dirt on the roots 4 feet across and 4 feet thick. Thoroughly wet this ball of dirt before hard freezing comes, so that the dirt will freeze solid to the roots of the tree. In digging down slant under the trees, so that the bottom will be like the bottom of a spindle-shaped top. In moving trees dug up in this way use cable chains. Wrap them around the ball of dirt so that they will draw up tight. Take great care not to injure the body of the tree by barking it when moving. The main requisites are good ropes, pulleys and plenty of help. The holes where the trees are to be replanted must be dug before the ground freezes. Move as soon as the dirt ball is frozen solid. Fill in and mulch heavily with coarse stable litter or straw. This mulching must be quite thick and extend out well around the trees. Large transplanted trees need special care as to this mulching, especially in dry climates, in order that the old forest litter of leaves may be supplied as to its moisture effect. There is no danger of too much mulching. Spade often in May and June. For nursery transplanting set all trees from 2 to 3 inches deeper than they grow in the nursery. If the soil is sandy draw good dirt to fill in around the transplanted objects.

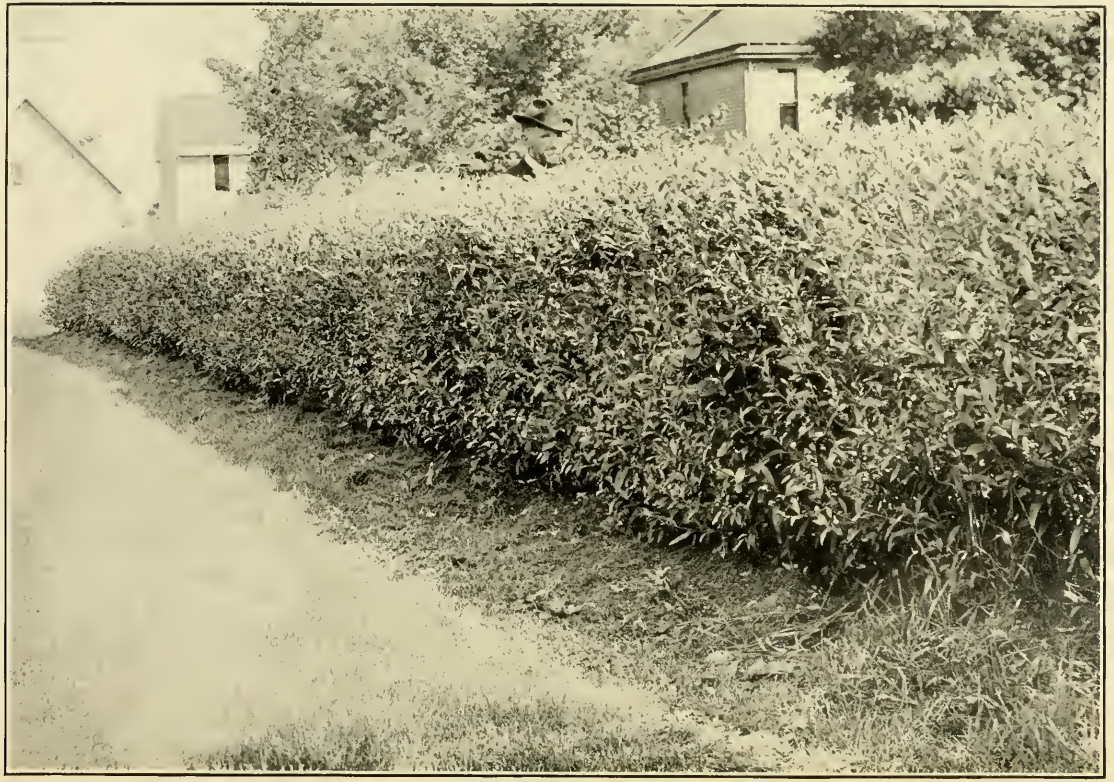
To Save Split Trees.

Ornamental or fruit trees that are split by wind storms can often be saved by boring a hole through the split branches. The size of the hole for small trees is ¼ to ½ inch. For large trees a larger size. Use bolts with a washer and burr on the bolt. Draw the split branches tight together, first filling in with white lead, with a heavy wrench. Some trees will require 2 bolts. I have known trees to grow together in two or three years so that no one could tell where the bolt was put through. Straighten leaning trees by driving a post in the ground opposite the leaning side several feet from the tree. The post should be driven solid into the ground—leaving about a foot above to fasten a strong wire to. Put a piece of old harness tug or trace around the tree near the lower limbs. Stretch the wire to the leather. The leather ends should not be drawn close together around the tree and the wire should not go around the tree. Many a good tree has been ruined by putting a wire around the trunk or limbs. Always use a stout piece of leather—any good old harness straps—and wind the wire two or three times around the post in the ground. In two or three years the tree will be straightened.

Pruning Trees and Hedges.

The beauty of all trees and hedges depends upon pruning.

All pruning of ornamental shade trees should be done so as to keep the top of the tree to be pruned in a concentrated shape. This



Golden Willow hedge, Hamline, Minn. planted by E. J. Grinnell in April. Photographed in October.

can be easily done by cutting back all straggling branches once each year. Too many people cut out the small thrifty limbs or branches from the head of the tree. And often by this thoughtless method of pruning the tree is more easily destroyed during a wind storm from being opened at the head, around the large limbs, giving the strong, hard winds easy sway, and they are thus easily twisted off. The small thrifty limbs in and around the head, where the large limbs are, should not be cut out. The old saying is true, "It takes an artist for a good trimmer."

The month of June is the best time to prune ornamental shade trees, as the tree will commence to head immediately after being pruned. The ends of all limbs cut should be immediately painted if the limb is one-quarter or more in size. Prune from the 10th of June to the 10th of July, and always in cloudy weather or after sunset in the summer time. If pruning is to be done in the fall, October is the best time, as at that time the tree is dormant, and all shrubbery that has made an unusual growth, should be cut back from ⅓ to ¼ of that season's growth.

Pruning should not be done in winter when the ground is frozen hard and the temperature is continually rising and falling. This condition continues in the northwest for about 6 months, and during this period all large ornamental shade trees, as the maple—sugar, rock, silver or soft,—birch trees, box elder and all kinds of trees that have sap in them freely, should not be pruned. Large losses have come from such pruning.

In pruning one should use only sharp tools and cut close to the trunk of the tree pruned, and paint immediately after removing the limb, with the best quality of paint, made of the best lead and linseed oil.

Hedges.

Buckthorn is one of the hardiest hedges known and the best known ornamental hedge plant, with the possible exception of the California privet, to stand close pruning without injury. When this hedge is trimmed the leaves quickly cover the cut and make it appear like a smooth and glossy wall of living green. It also bids defiance to the coldest frosts of winter, as well as the severest heat of summer. In order to get a pretty hedge the plant must be trimmed severely the first few years, so as to get numerous strong branches near to the ground. The principal thing in growing a hedge is to get a strong thick growth at the very bottom.

The plants are generally set one foot apart in single rows, yet when a very thick hedge is desired set them in double rows, each row about 10 inches apart and the plants about 18 inches apart in the row, setting rows diagonally across from the plants in the other row. The plants should be cut back to at least one-half their growth before planting. Immediately after planting, begin to cultivate, always keeping the ground loose and free from weeds. For winter protection mulch about six inches deep with coarse stable litter, straw, hay or leaves, and about two feet on both sides of the hedge. In the spring cultivate the mulching into the ground.

For hedging or windbreak evergreens dig a trench 3 feet deep and 2½ feet in width. Then fill in the bottom with well rotted manure to the depth of 18 inches. Tread this down closely and cover with a few inches of black dirt. Plant the evergreen some 2 or 3 inches deeper than in the nursery and fill in around the roots with well fined black dirt to within two inches of the top. Put coarse stable manure again around the tree, but keep it from the body of the tree. Then round up with black dirt again.

Some years ago I planted 24 beautiful pines at Litchfield, Minnesota. They were planted about the 24th of April, because the purchaser insisted on that early date, against my advice to wait at least a month. In spite of the general care used in transplanting they all died.

Later I planted six more for the same man, planting on the last day of May. Five of these lived and flourished. The sixth had very little root and died.

Newly set evergreen hedges should always be spaded with a fork-spade, two feet both sides of the hedge, and around the trees, from 4 to 6 inches deep at least once a month all summer. This improves color and hastens growth. Never use a shovel-spade in spading evergreens. It destroys too many roots and leaves the soil in chunks.

Open foliaged evergreens, when small, can be made to grow thick foliage by pinching out with thumb and finger on the center bud when it is nicely swelling to open in May. It takes from 2 to 4 years for a thick foliage in this way. The top of the tree should not be disturbed. If the top is broken out it will cause a crook in the tree. New green limbs should not be cut from the bodies of the evergreen tree. There are generally three new buds in spring on all of the outer branches and it is the center one of these buds which should be pinched when about the size of a thimble.

All litter from yard rakings, fallen leaves, dead twigs, etc., makes excellent mulching for hedges. Never prune evergreens in the middle of the day when the sun is hot. Dogs are a great detriment to evergreen hedges and if one will take time and money to enclose valuable hedges of this sort with chicken wire fence 2 feet high a good deal of damage will be prevented. Oak brush or oak saplings, as mentioned before, are also good.

I would add that if the soil is a light sandy loam I would always set nursery evergreens a little deeper than the 2 or 3 inches mentioned above. A clay subsoil makes the best home for transplanted evergreens, but in that case dig the holes 6 feet deep and 6 feet in diameter, with about 2½ feet of clay at bottom. A clay basin holds water and moisture in drouth, but if the natural soil is clay mix in one-quarter sand with it.

Coal ashes make excellent mulching for hedges, especially for those that are not cultivated and are crowded by grass and weeds. A good coat of ashes spread four inches from the plants on both sides of the hedges and 2 feet in width will insure the hedge from quack grass and keep fire away. This mulching should be from six to eight inches deep.

Watering Trees.

It is my firm belief that more plants and trees are killed by over than by under watering, unless the season is exceptionally dry. When planting a tree or bush fill in around the roots with the best of soil within four inches of the surface. Then settle the ground around the roots of the tree or bush firmly with water. After that try to conserve the moisture in the soil by either cultivation or mulching. The mulching should be put about 3 inches under the soil, that it may not interfere with cultivation. Remember that it takes considerable water to soak into the soil to any depth that will benefit the tree. Small amounts, often applied, are more likely to harm than do good. The soil becomes hard and baked and evaporation is greater than ever. Give the soil a good soaking when you must water and as soon as it is dry enough cultivate or mulch the surface so as to hold the moisture. The time to apply water to trees and all kinds of shrubbery in hot weather is after sunset. When the sun is shining, water, if it does not kill, causes rust and blight.

Miscellaneous Notes.

Other evergreens beside the American arbor vitae which make good hedge plants for different localities are the Scotch pine, Norway pine, hemlock and Norway spruce.

Among the hedge shrubs the purple barberry, buckthorn, rosa rugosa, spiraea, forsythia, osage orange, honey locust and privet may be grown with advantage if care is taken to choose only the ones adapted to your own climate.

The basswood or American linden is a vigorous grower, and while of pyramid shape when young, becomes at last a large, round-headed tree. The value of the blossoms for the honey bee makes this tree, apart from its decorative use, specially desired by most farmers.

Low growing trees should not be planted at the roadside, as in low, wet places, the mud will not dry up readily after a rain. In winter, also, they are the cause of drifts in roads. Elms, headed high, are excellent for roadside trees; and for the northwest this is specially true, as the rough bark of the elm protects it from sun scald. An elm will also bear more bad treatment in transplanting, because it has not only a good tap root, but many fibrous roots.

Cedar makes the easiest grown of all windbreaks. It is dense at the bottom and drouth and windproof. The seed (the red berries) germinates slowly, but it grows afterwards faster the first few years than any other evergreen.

Mountain ashes are subject to sun scald, having a very tender bark. If protected when small by something that will shade the stalk they will grow more bushy. They are a very pretty tree and are used extensively for ornamental purposes. The two common varieties are the European and American.

Black walnut and butternut trees do not stand transplanting easily, as they have very few lateral or fibrous roots. But the nuts of these trees, planted as soon as they fall, under the shade of some such quick growing tree as the basswood or ash, will thrive well.

Open trenches about four inches deep and cover well, and the nuts will sprout the next spring.

Large willow cuttings, closely set, driven into sod land which is inclined to be low and is damp in spring, will usually make good windbreaks. Prepare the willow cuttings in the winter, and bury in straw or earth to keep them moist and fresh until planting time, although the best results from planting are had by making the cuttings in the fall or early spring. The willow makes a successful windbreak or a good woodlot utilized in this way, but it is troubled by one insect pest which works ravages upon its usefulness.

The insect is a bark louse, which remains attached to the small limbs of the trees, multiplies rapidly and takes the sap from the small twigs to that extent that they are liable to die, and as a consequence injure or destroy the lower branches, which are so valuable in stopping the ground sweep of the winds.

Russian willow is said, by those who have used it for hedge rows, not to be troubled by this bark louse nor by worms. This willow grows fully as well as the white willow for hedges, has wood about as hard as that of soft maples, and a very beautiful glistening foliage. Posts from this willow, treated for rot, are being used.

The golden willow should not be started on sod land, but on land that has grown some cultivated crop. If golden willow cuttings are cut back to the ground at the end of the first or second year of growth they will make a much thicker hedge for a shelter. A good solid willow hedge makes fine protection for evergreens.

The Carolina poplar, which is simply a variety of our cottonwood tree, is usually grown in its staminate form, and therefore is free from the objectionable cottony seed. It is the best poplar we have, but it does not grow to advantage on very dry soil. Plant on moist ground, like that of a river bank, which was its native home, and you will have a grand tree.

The Tree Borer.

The European alder and willow borer has been at work on the Carolina poplar. Prof. F. L. Washburn, of the Minnesota Experiment Station, gives this description of it as a dark "brown beetle, about half an inch long, with a long snout. It has a conspicuous white patch on the rear part of its back, and some whitish on its sides near the head. It makes a hole in the poplar stem or trunk, lays an egg therein, and the larva hatching bores into the bark, and into the solid wood.

"When trees are young they are easily killed by this pest. When only a branch or stem is affected, it may be cut off in June, with the contained worm, and burned with the culprit inside. A good preventive to young stock in the nursery or elsewhere would be a whitewash on the trunks, containing a liberal allowance of Paris green, applied two or three times during May and early June. Jarring the trees in May and June, in the morning, causing the beetles to drop upon a sheet below is also suggested. All farmers planting windbreaks should watch out for this pest."

Wood borers can be destroyed by working with fine wire into their holes. As they usually bore through the bark near the base

of the tree, a whitewash made from lime and soft soap will help in keeping these pests and others away from their mining work.

Another good way to keep the borer away from almost any tree, especially fruit trees, is by wrapping the trunk with stiff building paper, having it extend from a few inches beneath the soil to a foot up the trunk. The moth that lays the eggs must then go higher up, and the young are exposed to the elements so much that the larvae are usually killed. But keep up a thorough searching of the soil every spring and fall just the same.

Tree Stories.

Newark, N. J., has long been noted for its beautiful shade trees. That city started tree planting nearly 250 years ago, as may be seen from this paragraph in the old town minute book:

"Feb. 6, 1676. The town seeing some trees spoiled in the streets by barking or otherwise; the town hath agreed, that no green tree within the town as is marked with N, shall be barked or felled, or otherwise killed, under the penalty of ten shillings so killed."

Probably the thrifty settlers of that day were careful as to how they injured the village trees after that. When we remember that trees are self-sustaining, after they have been well started and properly cared for at first, it is stranger still to understand why farmers neglect to plant them.

The following story, for which the writer does not vouch, has a good deal of interest in it, because it shows, if true, that nature has great recuperative powers if we know how to influence them to action:

"A contributor to the 'Country Gentleman' tells of an old tree having been rejuvenated in a remarkable manner. It was a very ancient walnut, with long, gaunt boughs carrying much deadwood, and here and there bearing a few leaves. For several seasons it had been struggling in this way to live, but each year manifested signs that its life was fast disappearing. Then a wonderful thing occurred. The keeper in front of whose house the tree stood, took to slinging the body of each deer he killed on to one of the boughs for dressing. The following spring this tree put forth an astonishing crop of leaves, and in less than three seasons it was making new wood and showing all the vigor which had characterized it thirty years before. Its renewed youth was entirely attributed to the fertilizing properties of the blood with which it had been so liberally dressed."

CHAPTER XIV

The Flower Garden

Soil Preparation.

ALL flowers should be grown in deep, rich, mellow loam. If the soil is clayey and apt to bake, it must be thoroughly fertilized with well rotted barnyard manure and a mixture of some sand, one-third sand at least. Spade or plow deep, break the soil up well and rake the surface very fine. Fresh or unrotted manure is liable to burn the roots. Cow manure is the best for flower beds. A teaspoonful of ammonia in a gallon of water makes a good fertilizer. This is to be applied to the soil once a week and is very good for verbenas and asters. Ashes, liquid manure, and nitrate of soda are very good flower fertilizers.

The Making of the Flower Beds.

In making a flower bed, see that the ground is well drained; that the subsoil is deep, and the land in a mellow condition, and that it is rich. Make the beds always in the fall and each fall give it a mulch of rotted manure, which may be spaded under deeply in the spring.

This method distributes the fertilizer more equably and permanently through the soil. Plants and seeds in such beds begin to grow and germinate at once in the spring.

Old sod or dead grass make fine fertilizers. Combine the sod with one-fourth sand and one-fourth well rotted manure. For some soils 4 qts. of salt to the soil of a bed, 10 to 12 ft. in diameter, is of value. The salt helps to destroy worms and to retain moisture. When salt is used, however, it should be well mixed through the beds in the fall, and two bushels of air-slacked lime added in the spring. Spade in well and work over often. If your soil is sandy naturally, however, omit the sand from the mixture. But the lime and soil applied each year will free from insects and cut worms. Make the flower beds as broad as possible, so that the roots of the grass running in from either side will not meet beneath the flowers and rob them of food and moisture. It is well to add a little commercial fertilizer each fall and spring.

Transplanting and Cultivating.

In out door culture surplus plants should be transplanted. This may be done at any time when the plants are quite small. The best time is after a soaking rain, in the latter part of the day. Take up the plants carefully, pressing the soil about the roots and make the hole large enough so that the roots can take their natural position in planting. Draw the soil up about the plant and press firmly. Give a good sprinkling, and shade from the hot sun a day or two. The soil

should be well cultivated once every week. The loosened soil on the surface acts as a mulch and saves the moisture. Give the plants plenty of room. Good results cannot be had from crowded beds.

Watering.

Watering the garden plants should be done with great care. Many a flower garden is spoiled by too much watering. It is better to save the water in the soil by frequent cultivating with the garden rake or hand weeder. But if the soil should become so dry that the plants do not thrive, then water the bed. Do not sprinkle, but water thoroughly after sundown once or twice a week, applying water to the roots from the spout of the watering can. Rake the surface over again in the morning when it begins to get dry.

Seed Sowing.

Seed should not be sown until settled warm weather. Too early sowing is the cause of many failures, and another mistake is in covering too deep. Always cover only one or two times the thickness of the seeds, but for coarse seed a quarter or one-half inch is not too much.

Mix fine seeds with ten to twenty times their bulk of sand and sprinkle them over the seed bed with a pepper box. Then add a light covering of fine white sand, which will not crust nor bake in the wind and sun like a clay loam. The latter often does not yield to the upward pressure of the tiny plants. Keep a supply of fine, sharp sand on hand. When seed is sown in the summer, it should be put a little deeper than in spring, and the soil firmed very thoroughly over it.

Always press the earth down firmly after sowing all flower seeds. A second sowing ought to be made in from two to four weeks to secure a succession of bloom. In starting flower seed of any kind, only heat and moisture are required until they sprout through the ground. Do not water unless very dry, then be sure to cover as above directed, to prevent soil drying out and crusting over. A board laid on the earth over the seed will also prevent washing out by heavy rains.

In-Door Seed Sowing.

Take equal parts of fine, clear, gritty sand, and surface earth from the woods or soil, cut from beneath turf full of tiny grass roots. Take a box and bore some holes in the bottom to secure a good drainage. Cover the bottom with pieces of broken pottery or small stones before putting in the soil. Press down the soil, smooth it over with a piece of lath or flat stick, and saturate with water and wait for it to drain off. Make shallow drills with the edge of a ruler about two inches apart and sow seed, sifting soil over according to size of seed. Cover with glass and place in the sunshine. The temperature of the room should not go below 60 degrees at night and should be from 70 to 75 degrees in the day time. While the seed are germinating the soil should never become dry. Spray (not water) carefully only when no moisture collects on the under side of the glass. Give fresh air daily and before transplanting out doors, harden the plants by putting them out of doors on pleasant days in the sunshine.

House Plants.

The best soil for all varieties of house plants is obtained from thoroughly rotted prairie sod, heavily grassed, which should be placed in a pile, grass side down. About 100 lbs. of slacked lime to each load of sod, or two or three quarts of slacked lime to a bushel of sod should be well scattered among the sod. A small quantity of wood ashes mixed into the rotted sod is excellent for all flowering plants, also a little sand mixed into the soil. The sand draws heat, and keeps the soil from baking, from over watering, or from going too long without water. If you can only get heavy clay soil for your house plants, mix in one-third sand. The richest soil should have shallow cultivation. This can be done with a common table fork, and once in two or three weeks is sufficient. It is also good once in a while to add a little new soil. Be sure to watch for insects. All house plants should have a vessel of hot water or a wet sponge placed near them. The sponge may be hung up so that it will be near the flowering plants.

Nitrate of soda is a fine stimulant for sick plants. Dissolve a teaspoonful in one quart of warm water and use twice a week as long as needed. For outdoor plants a thin layer of sand over the entire root of the plant will help to retain the moisture.

Nitrate of soda should be used as follows: One handful of soda to 50 gals. of water, but only a small grain to one cup of water. Some use ammonia. When this is used, put one teaspoonful to 1 gal. of water and always apply with a spray. For out-of-door roses, use white hellebore mixed with flour equally, and dust on through tiny holes made in a common tin can with a nail. This should be done while the dew is on, but never when the wind blows. Nicolicide is used to kill all kinds of insects. Use from one to two drops in one teacup of water. Spraying once will be sufficient.

All vines, shrubbery and ferns should be planted in their natural soils to thrive the best. I planted a wood vine, or fine leaf ivy, in leaf mold soil about May first, in the spring of 1908. It made a growth of 16 feet and 4 inches by October 15, 1908. The wood vine plant was nearly one year old when planted, and was cut back to four inches in length. There should be placed about one wheelbarrowful of leaf mold soil, brought from the woods, around each vine or shrub.

Alphabetical List of Varieties.

Ageratum. Hardy annual. Start in-doors or in cold frame, if desired, for early blooming in March, but for summer and fall bloom the seed may be sown in well prepared beds in the open about May first.

Althaea Rosea or Hollyhock. Plant seed as early in the spring as possible, and transplant or thin to one foot apart. Time of germination, 10 days.

Alyssum. This is used a great deal for borders and rock work. The seed should be sown thickly so as to form masses. For winter bloom sow late in August, but for spring bloom the seed should be

One of the greatest flower beds ever grown in Minnesota, corner of Hewitt and Snelling Ave., Hamline. The large foliage plant is Canna. The border of this gigantic bed is composed of many-colored geraniums and other flowering plants. Planted by the author.

sown in the open early in the spring, as it will stand considerable frost. While white is the most common and popular color, there are yellow varieties of alyssum also. When bloom fails cut back the plant and it will bloom again.

The anemone, meaning wind flower, is a genus composed of about 85 species, among which are some very handsome garden plants. They are perennials and natives of the north temperate zone. They will do well in any good garden soil, but a well drained, rich, sandy loam is best. Some of the tuberous species are best adapted for hardy borders, and if used for winter blooming will require about the same care that should be given the hyacinth. For out door planting, September to December and February and March are good times.

Aster, Chinese. One of the most popular annuals for fall blooming. It is a native of China and was introduced into Europe about 1731 by a Jesuit missionary to China. These were all the single flower type, but soon the double flower was produced, as were also other variations in form and color.

Culture. Secure good seed. Have the soil well manured the preceding season.

A mulch of tobacco stems is said by some growers to be good if applied at time of bloom, as it keeps down weeds and kills the root aphis.

To have a succession of blooms sow some in the house or in cold frames in March or April, and in May sow in the ground in the open in a specially prepared seed bed. Sow about a quarter of an inch deep and cover with burlap or old carpet, water through the covering, and keep the soil moist. When an inch high transplant to about four inches apart, and when four inches high transplant again to twelve inches apart or more for the branching kinds. In this way much finer plants are obtained. If troubled with the black aster bugs look for them three times a day during the flowering season and knock them into a pan and destroy them. As different varieties come to maturity at varying times one may have a long period of aster blooming.

Bachelor Buttons, Centaurea Cyanus. Sow in the open ground as soon as danger of frost is past, and transplant to one foot apart.

Balsam. Water with manure water occasionally. These plants need plenty of sun and room to insure nice double flowers.

Balsam, Impatiens Balsamina. This annual was long ago introduced from India, and is now widely cultivated for its showy blossoms. Since then it has varied greatly in size, color and form.

The culture of the balsam is not difficult. The seeds are large and germinate readily, but the plants are sensitive to frost and should be started in thumb pots until all danger of frost is past. The soil should be a rich, sandy loam, and the plants ought to be set about two feet apart each way.

Begonia. Very popular as a house plant. The first begonia was brought to England in 1777. 350 species are now known, while perhaps 150 of these are of use to florists. The development of this plant

has been very rapid and the colors both of flowers and leaves are very gorgeous.

They are divided into four groups:

1. Winter flowering. Fibrous rooted.
2. Semi-tuberous.
3. Summer flowering. Tuberous rooted.
4. Rex.

Sow from January to March in a good box or flower pot in good soil. Cover with glass and set in a dark place, not too warm, until seed begins to germinate, then bring to the light gradually, but do not give full sunlight except in early morning or late in afternoon. Keep soil moist, but not wet. When second or third leaf appears transplant, etc. Begonias dislike close atmosphere and hot sunshine in their earlier days. They may be headed out by the middle of June.

While during the summer the sun may hurt begonias, during the winter and spring they can not get enough of it.

The soil must consist of good loam, well rotted manure, leaf mould and sand mixed to a good consistency. They are not very liable to insect attacks, but sometimes are troubled by fungous diseases.

Candytuft. Sow in fall or early spring. Any good soil is suitable; thin out to four or five inches apart. It takes about 16 days to germinate.

Candytuft, Iberis. These annuals are grown in masses in the garden and by florists for cut flowers. They can do well in any rich garden soil with plenty of light and air.

It got its name candytuft because it was brought from Candia and its flowers appear in tufts.

Columbine. Hardy perennial in the northern hemisphere. There are about 30 species, and are among the most beautiful of hardy plants. They do best in a light, sandy soil, well drained and in a sheltered location where they can be in the sun. Propagation is best done with seeds.

Canterbury Bells, Campanula Medium. Sow in fall or in May in light, rich soil, and thin out to two feet apart. They bloom the second year.

Carnation. Sow in-doors (See "In-door Sowing") or in the open ground in April or May. A sunny location with some sand in the soil is the best. In most regions, if well mulched with strawy manure, the plants will live out over winter.

Chrysanthemum. Sow in boxes in spring and make several transplantings, as they advance in growth. In September lift into large pots. Water well and keep in a sheltered place.

Columbine, Aquilegia. Sow the seed in the open in spring where the plants are to grow, and thin the young seedlings to about a foot apart. The columbine is a hardy perennial, with many horticultural varieties, and is a desirable border plant. Few hardy perennials are so easily grown from seed.

Delphiniums, Larkspurs. About 60 species of beautiful, hardy plants. Native of north temperate zone. Annual and perennial.

They do best in rich garden soil that is well and deeply prepared. The perennials are propagated:

1. By root division in fall or spring.
2. By cuttings.
3. By seeds started in greenhouse in March.

The young seedlings must have plenty of room and may be set in the garden in June. These will flower in autumn. Seeds started in late spring or summer flower the following summer.

The annuals are propagated from seed, which should be sown in the fall for early spring flowers.

Daisy (Bellis Perennis). Treat same as Pansies. Set eight inches apart.

Dahlia. To insure bloom the first season, sow in February in-doors or in cold frame. If sown out of doors in May it will come into full bloom late. Prune off some of the branches, letting only two or three grow.

Evening Primrose. The evening primrose is a choice, free-blooming annual, with widely open flowers of satiny texture, with delicate colors. The seed should be sown in an open border or in a cold frame in spring. If the latter, the seedlings should be transplanted to stand about a foot apart in rather thin or sandy soil. The blooming season is from early spring until frost.

Eschscholtzia, California Poppy. Sow where plants are to stay and thin out to six inches apart. They do not stand transplanting well. Germination, 14 days.

Feverfew. May be sown in-doors or out. Observe direction for fine seeds, although in-door sowing proves the best.

Forget-Me-Not. Sow in early spring, but best to sow in cold frame in July or August, transplant to a shady position and keep well watered during dry weather. Will sometimes bloom the first season.

Four O'Clock. Will grow in any common garden soil from seed sown in the open ground. Sow in May. Set two feet apart.

Fuchsia. After plants are started give rich soil and water with weak manure water occasionally. Do not need high temperature, but plenty of light and air.

Geranium. See "In-door Sowing." Place in the dark until seeds germinate, then admit light.

Gladiolus. Sow in drills about half inch deep in well worked soil, cover with hay or grass clippings. When well up remove the covering and keep soil loosened about the plants all summer. Take up the tiny bulbs after the first frost, and set out the following May; many will bloom the second year.

The culture of gladioli is very easy. Conditions suitable for potatoes prove very good for them. Succeed best in moist, sandy loam. Propagated in three ways:

1. Division of bulb.
2. By seed.
3. By small corms growing at the base of parent bulb.

Heliotrope. Do not sow with other seeds, as heliotrope needs a higher temperature, with rich soil. Sow in a flower pot, cover and keep in a temperature of about 70 degrees. Set in the ground in May.

Hollyhock. If planted in the fall or started in the house early they will bloom the first season. Or sow out doors in April, transplant when they have 3 or 4 leaves. Do best in deep, rich, well drained soil.

Iris. Sow after settled warm weather; will grow anywhere, but does best in moist situation.

Marigold. Sow in early spring 18 inches apart.

Morning Glory. Sow early, thin to 8 inches. Sow each seed singly in small pots in April and transplant out doors after the frosts are over. Sow in good ground in sunny situation.

Mignonette. Cover a little deeper than general rule, and firm the ground down well; thin to 6 inches apart for nice fall plants, make second sowing last of June.

Nasturtium. After settled warm weather sow in open ground, firming the soil well over the seeds. A sunny location is the best. If soil is too rich they run to vines. Set one foot apart. It takes from 12 to 16 days for germination. Very common and easy of culture. The watercress is a member of the genus, of which there are 20 widely scattered species.

It is sometimes used as a food.

It is occasionally attacked by a green worm with biting mouth piece. To stop its ravages use hellebore or flour and paris green. Frequent applications may be necessary, as the leaves are very slippery.

Peonies are plants of the hardy perennial herbs so much grown and liked. They are natives of Europe and Asia. They are not usually subject to insects or fungous diseases. At present there are about 1,000 double varieties. In 1855 there were only 24 double varieties. Peonies do best in rich, deep, moist loam and need a large quantity of manure, worked well into the soil. Also they need a great deal of water.

Peonies are propagated:

1. By division of roots. This is easiest and most satisfactory. May be lifted and divided from middle of August until stalks appear in the spring. Early fall is best. There may be as many divisions as there are eyes.
2. Grafting.
3. Seeds.

If seed can be sown in fall, shortly after maturity, it will come up the next spring; otherwise it will lie in the ground from one to two years, hence sow where soil will not be disturbed and wait.

Pansy. The pansy requires a very rich soil and a partially shaded location. Spade the ground in the fall, and work in rotted cow manure. Give plenty of water, and to get best results keep the surface soil loose. Sometimes a mulching of grass clippings can be used. In early spring make drills one-half inch deep and 8 inches apart, and

sow the seed thinly, but cover very lightly. After the plants have several leaves transplant to about 8 inches apart. Start the seed in-doors in February or March, according to latitude, though seed sown in July will give bloom late in autumn. Cover with leaves in winter.

Petunia. Sow common petunia out of doors. Sift a little sand over the seed as soon as it germinates, keeping on the slats or glass a day or two longer. It takes about 14 days to germinate.

Phlox. Sow in ground in late fall or early spring. Germinates from 6 to 20 days. Perennial. Few annual plants are more easily grown from seed, give such quick return of bloom or offer such a variety to choose from as do the phloxes. In transplanting set the taller kinds about a foot apart. The average height of the plant is about a foot.

Poppy. Sow in fall or early spring where plants are to stand, and thin to about 8 inches. Cover with a sprinkling of earth and press down with the hand. Best to sow these in September.

Snap Dragon. Sow late or start in-doors or in cold frame. When germinating give barely enough water to keep soil moist.

Sunflower. The seed should be planted in the open garden about the same time that corn is planted, and the plants thinned to stand from 2 to 4 feet apart, according as the plant is dwarf or tall growing. There are different varieties, which range from 2 to 10 feet in height, with from one to many flowers.

Sweet Peas. Sweet peas require a soil deeply tilled and well supplied with plant food. A good method is to open a trench in the fall about two feet wide and two feet deep in rich garden loam.

Fill this trench with an equal mixture of well rotted manure and good soil mixed either with one-quarter hardwood ashes or air-slacked lime.

All should be thoroughly mixed before placing in the trench.

Plant the pea seed one and one-half inches deep, and quite thick, as follows: Press the peas down with the hand before putting on the surface soil of 1½ inches in thickness.

Do not press the top soil very hard. As soon as the peas are an inch high cultivate them every other day until they commence to bloom.

Use water sparingly.

After applying water cultivate as soon as the water has settled into the soil, for if left uncultivated the soil will bake and become hard.

Smilax. Soak seeds in warm water 12 hours and sow in-doors in February or March. Keep in warm, moist place.

Sweet William. Sow in spring or fall in the ground and thin to one foot. New plants should be raised every few years from seed, as the plants degenerate.

Verbena. May be sown out doors or in-doors in February or March. Keep seedlings in cool, sunny place, not too warm, and when weather becomes warm put in a sheltered situation out of doors to

harden before setting into the ground. Don't do as well on clayey soil; light, rich, tufty soil best.

Violet. Pour hot (almost boiling) water on the seeds and let stand four or five hours; sow in May. Germination from 2 to 6 months.

Zinnia. Sow early and transplant or thin to 6 inches apart. As the first blossoms appear, pull up plants with single flowers and transplant others to 8 inches apart. Strong, rich soils suit the zinnia, and during the month of August they are at their best. The plants can be used for groups, beds, borders, garden lines, and summer hedges. Their average height is 1½ feet. The zinnia is easily grown.

Damping Off is the rotting off of cuttings or young plants near the surface of the soil. It is the work of fungi; but these fungi are injurious because they find conditions congenial to their rapid growth. Prevention is worth more than cure. See that the soil is wet clear through. Keep it as dry as possible on the surface. Avoid soggy soils. On peaty soils, sprinkle sand or coal ashes to keep the top dry, give the plants free circulation of air and abundance of room. If damping off threatens, transplant.

Boston Fern.—Perhaps the most popular of ornamental foliage plants is the Boston fern, better known as the sword fern. This plant is too well known to need description. When well grown it is a most beautiful plant, but as ordinarily grown it fails to do itself justice because conditions are against it. It is one of the easiest of all plants to raise, if its requirements are understood and met. It must have a light, spongy soil in order to do the best, and be given plenty of root room.

A year old plant ought to have, at least, a 12 or 14-inch pot to accommodate properly its many roots. A good soil for it is made by mixing leaf mold with thoroughly rotted grass sods. The grass sods should be rotted a year before use. Prairie sod is the best. Mix one barrel of air-slacked lime to one large wagon load of sods when piling them to rot. When thoroughly rotted, mix one-third rotted leaf mold from the woods where no grass or weeds grow. This mixture of soils is excellent for almost every kind of plants and flowers. In such a soil any fern will grow well, provided other conditions are favorable.

"Hard" and "Soft" Wood Cuttings.

Cuttings are of two kinds, viz., "hardwood" and "softwood." Hardwood cuttings are more difficult to root than the "softwooded." A softwood cutting will "callus" or heal and form roots, no matter where the cut may be.

The azalea and abutilon are hardwood cuttings; the geranium and coleus are types of the softwood cutting. Hardwooded plants have a woody stem, a pithy center (in a young state) and a well-defined bark; a hardwood cutting will bend right over without snapping or breaking, but a softwood cutting does not show these characteristics and will snap clean through if bent to a right angle. A hardwood cutting should always be cut close to a leaf joint, the wood at this point

being firmer and less pithy than at any other, and it roots most readily when taken off the old plant in a young and growing condition. Always use a sharp knife, and have a heel (or very small part of the older stem) attached to the cutting.

Aside from great financial saving that results from propagating plants at home instead of buying them each year, the pleasures of gardening are greatly increased by this practice. Where we have had one or two of a kind we can have forty or fifty at no greater expense.

The early care of the cuttings at the critical time of their existence must not be neglected. In every household there is some corner where we can save over some of our favorites of last summer from the ravages of Jack Frost.

Cutting

The ideal cutting should be about three inches long, short jointed and firm. Two or three fully developed leaves should be left. The others—and also the bracts and flower buds—should be broken off close to the stem. When carelessly cut off the portion of the leaf stalk left behind usually decays, and many of the failures and much of the "damping off" can be traced to this. "Damping off" is a rot that kills the young plants before they are properly rooted. Have your knife sharp and do not squeeze it through, nor yet make a long, diagonal cut, as if whittling a stick. Hold the portion that is to be a cutting with the thumb and forefinger of the left hand, place against it the thumb of the right hand (which holds the knife) and then draw the blade through the stem. Commence with the base of the blade and draw toward the point. Do not let the edge of the blade strike the middle of your thumb. This disfigures your thumb and bruises the cutting, as it is squeezed between the blade and the thumb. When the thumb is merely used to steady the cutting and the blade drawn through, so as to come out at the side of the thumb, the disfiguring and bruising are avoided. Geraniums may root readily with less care, but the principle of making a cutting holds good in other things, and the geranium is a good steady plant for the amateur to begin on as practice.

If it is desired to have a large quantity of geraniums the cuttings must be put into boxes or flats, which should be two and one-half or three inches deep, and any length and width that may be desired, so long as they can be conveniently handled. They must have holes in the bottom for drainage, just as is done for window boxes. Cover the bottom with a thin layer of leaf soil or light turf, and on top of this about two inches of clean sand.

Striking the Cutting.

Sand is the best medium for use in propagating—the cleaner the better. A cutting, having no roots, if placed in material containing decaying organic matter is liable to be attacked by disease.

Place the cuttings in the sand about one and one-half inches deep and two inches apart each way, and make the sand quite firm around each one. After the box is full soak thoroughly with water and place in the sash bed or window.

Shade with a newspaper for a day or two, and in from three weeks to a month your cuttings will have roots and require stronger nourishments. One good soaking is usually sufficient watering until the roots appear. But give a light spraying on bright days to prevent undue evaporation. This keeps the leaves fresh.

As soon as well rooted the cuttings should be potted up in small pots or boxed over again in fairly fertile but light soil. Water carefully until well established, and never allow the young plant to flower until it has an abundance of roots.

Other plants which can be treated in the same way are: Heliotrope, ageratum, begonia, alyssum, cuphea, fuchsia, alternanthera, salvia, abutilon, hibiscus.

The coleus wants a closer, more humid atmosphere, and if possible, more heat. This can be secured by covering with a bell glass, or the flats may be surrounded and covered with panes of glass, thus forming a complete case. A coleus will root in from seven to ten days in a dwelling house, but if the cuttings once get thoroughly wilted they will never recover.

If only a few plants are needed, two and one-half or three pots can be used instead of flats. Use leaf mold and sand, the same as in the window boxes, and insert the cuttings so as just to touch one another around the edge of each pot, and the same treatment as described above holds good in every other respect.

Ferns of the Boston type can be readily increased at any time by breaking off some of the small plants (with roots intact) that grow around the edges of the large pieces. Pot them up in any size pot that is sufficiently large to contain these roots, but never "over-pot" them (over-potting is putting a small plant in a big pot). They form roots much more quickly in a small pot, and they can be repotted often as they require it. Any plant needs to be repotted into a bigger size as soon as its present pot gets full of roots, and no sooner. Growth is much quicker, too, if only a small shift is given each time. It is best to use a pot about one size larger, or say, from a three-inch to a five-inch, from a five-inch to a seven-inch pot, and so on.

Rose Culture.

Roses, among the most beautiful of flowers, are the easiest to raise to perfection. They only require thorough cultivation, good soil, and an abundance of well rotted manure. A clay loam is the best for roses, but a sandy soil, well prepared by a layer of thoroughly broken up clay at the bottom and heavily manured with rotted manure, well mixed in, with a thick covering of black earth, will make a good soil for rose growing. Such a soil is best prepared by thoroughly plowing or spading the dressing, according as you plan for rose growing on a large or small scale. Roses also need a sunshiny spot and a free circulation of air. Don't choose a bed under trees or in the close shade of many buildings. They may mildew from that cause and also from poor drainage, or from prolonged wet weather.

Cultivation is very important, and must begin immediately within twenty-four hours. Mulch heavily with rotted manure and spade it

into the soil with a fork-spade. Keep the soil loose and free from weeds. This surface cultivation is needed at least once a week, and if the season is very dry, even twice a week. If you have a number of rose bushes try to save all the moisture you give the roses when watering by digging little trenches between the bushes, which will carry surplus water where you want it to be and not waste it on the soil around. Roses need a great deal of moisture, but they must not stand in it. A wet blanket at their feet is death to roses. When you water do it in abundance. Then give them a rest from watering for a time. Frequent cultivation will keep the moisture in the soil by keeping it from baking and making it loose and fine. One rose grower recommends mulching with lawn grass clippings about the first of July. On a farm, coarse stable litter or hay would serve equally well, taking care to keep it away from the stem.

Pruning Roses.

Rambler roses may be planted in the fall. In some climates these need no protection if they are strong plants when set out and are carefully planted. If planted along a fence or wall, set them from eight to ten feet apart. As these roses bear blooms from wood of new growth each year, growing from canes of the season before, it is very necessary to prune them thoroughly every spring, so that the old wood remaining on will not take vigor that should go to new shoots each year. As one nurseryman puts it:

"The greater the growth of new shoots this season the more buds there will be produced, and the more buds there are produced the greater will be the number of flower-producing shoots next season. After the plants have been pruned, spade a quantity of rotted manure into the soil about the base of the plants, to induce a strong growth of new wood during the remainder of the growing season. The flowers will be borne next season on the wood sent out from the now dormant buds. The buds on the wood arising from wood that is two or more years old are invariably weak and when there are strong young shoots coming up from below, the old wood ought to be cut away and the young shoots allowed to take their place."

An amateur in rose growing, however, would do best by consulting some experienced rose grower before experimenting much with any kind of roses as to pruning. Cut out all old or dead branches, and some of the top should be cut back early each spring. Opinions as to how far this should be done vary. In general about half of the previous season's growth should be cut away. If your roses are from budded roses, cut root sprouts or suckers way back into the soil, so that they will not take life from top growth.

Winter Protection.

The time at which roses should be given winter protection varies so much as to climate that no exact date can be named. In freezing latitudes all roses are benefited by some protection, even the so-called hardy ones. In some mild localities tender roses will need only a mound of earth covered with long manure and reaching up above the

lower branches. The top will be winter-killed, but as this is pruned in the spring it will not injure the plant. There will be enough canes left for the next summer's blossoms.

In severe climates, though, much more thorough means must be used to keep roses in good condition through 20 degrees below zero blizzards. I give several methods, used by different rose growers with success. For number one, put from 6 to 8 inches of dry leaves or straw on the ground, after breaking up the soil around the bushes so that the canes can be bent down as far as possible. This layer of leaves not only keeps the canes from cracking when bent down, but also insures a dry bed for the winter, with no ice to settle around the roots of the plant. If there are several bushes together, mulch the whole plot heavily with well rotted manure before laying down. Then use the leaves as above.

If possible, arrange the bent canes so that they slant up on a slight incline. After they are well laid and fastened down with pegs, cover with leaves or straw, followed by a layer of sods placed upside down, or else by tar paper. Over this put coarse manure and a top layer of sand. Poisoned corn meal sprinkled among the canes or bushes will kill mice. Do not uncover too early in the spring. This covering can be taken off in layers, beginning on the north side of the rose bed. Take about ten days for the process of uncovering, removing about one-third at a time, and leaving the mulching to be spaded in.

Another method of winter protection for roses, where it is not convenient to lay them down on the ground, may be followed. Wrap a thick coat of long rye straw around them with binding twine. Then wind with burlap or an old grain sack from one to six inches of thickness. But this method is not advised for a cold climate, nor for tender varieties of roses.

For a climate where the winters are cold, yet there is little snow on the ground, the most hardy varieties are the Scotch pink, Madame Plantier, white, which is a generous bloomer, the moss pink, the cinnamon rose and Harrison's yellow. Many rose growers claim that these need no protection beyond that given to any hardy shrub; but by way of extra precaution it can do no harm to put a barrel or box around these, which can be filled with leaves, fine straw or hay. A banana crate makes also a good covering, filled in the same way, and fastened down by slats to keep it from being blown over by winds. Such coverings for tenderer roses can be banked on the outside with stable manure and litter, which should not be removed before May 1. The rest of the protection about May 15. Imported roses can be safely wintered by this method.

If a permanent protection is desired, prepare several twelve-inch lengths of one by two-inch boards by sharpening one end enough to drive them in the ground. Bore half inch holes in these two inches from the top end. Through these, after putting them in the ground on each side of the rose bush, after laying down the canes, insert half inch strips of light wood. This will leave the canes above the ground well and prevent breaking. The pegs can be used each year.

Rose Hedge.

For a rose hedge dig a trench about 3 feet deep and 4 feet wide. Fill in to about 18 inches with thick grass sods, grass side down, and above this put 8 or 10 inches of good soil, mixed with well rotted manure. Set the plants then and fill up to the top with black soil and sand on the top. For hedges, either one color or a variety of species can be used. This last method insures flowers for a longer time. Set the bushes from 16 to 18 inches apart in the row and incline each row up slightly.

An excellent way to get liquid manure for the rose garden is to fill a barrel or box with manure. This receptacle should have a few holes bored in the bottom and be set up slanting so that the leach from it will run into a trough or pail. Give this plenty of water and wet the soil around the roses once a week with the leach from it. Your roses will soon show its value, in size, color and perfume.

If you find you have roses planted in the wrong location, the only thing to do is to transplant to a sunny, bright place, away from tree growths, which will be likely to take up the soil values.

When To Plant.

The best time for planting is in the early spring. If you are getting your roses from a nursery do not open up the plants until the ground is ready, but wrap and store them in the cellar after sprinkling well. Cut back the plants to six-inch canes and set them in the prepared holes, filling in firmly around the well spread out roots and watering abundantly as you do this. Be sure to fill thoroughly, and press down hard, as firming the earth well is one great secret of any planting. Don't tread the soil. Where roses are on their own roots set a couple of inches deeper than when in the nursery. If the plants are budded, set several inches deeper, so that the bud will be about three inches below the surface. As there are many fine varieties of roses that are too weak to grow on their own roots with success, it is always worth while to try the grafted kind, bedded on hardy stock.

Growing Rose Cuttings.

Roses on their own roots can be grown by any amateur gardener by taking cuttings in the fall, about 8 to 10 inches long, and keeping them over winter in moist sand. In the spring plant out in soil prepared as above, and transplant the second year to their permanent home. There are so many kinds of such roses to be had that the amateur rose gardener can experiment with little expense in this way, getting cuttings from friends or from nurseries, where such cuttings can be had cheaply. There is, of course, more pleasure from your own results of this kind, if your labors are at all successful, than there is from nursery stock, though the latter can be had very cheaply.

If you want to get a few fall flowers from your outdoor rose plants, try pruning them. As son as they are through blooming, cut back this season's growth to a very few bud stubs—a half dozen is enough. The shoots that will develop from this pruning will bear blossoms in the fall, wherever early frosts are not likely. Judicious

pruning all the season will not harm. It can be done while picking the blossoms.

Planting Climbers.

The president of the Minnesota State Rose Society gives much valuable information as to planting climbers in the following directions:

"Dig a hole 2 feet square by 3 feet deep. Fill in partly with stones or brick in the bottom for drainage. Fill in the hole with rich earth mixed with well rotted manure and a small quantity of bone meal.

"Have the manure well rotted, or if fresh, put below the roots so as not to burn them. Plant these climbers in April or first part of May to become well established before fall, planting about a foot away from a brick wall, for the brick absorbs a great deal of moisture. A stone wall would be cold. Climbers can be planted in standing position with the roots well away, if planted near walls. I shall speak here of the winter protection necessary for climbing roses.

"Draw the soil up about the main stem, about 4 inches high, place straw on the ground, making a warm bed for the vine to lie upon; take the rose from the trellis (and by the way, do not use poultry wire for roses, as they push through the wire and are hard to take down in the fall); draw the branches together, lay them down on the straw, cover them carefully with straw about a foot deep, finally covering all with tar paper to keep out water.

"Rugosa roses are hardy Japanese roses, making a dense growth, foliage rough of a dark, glossy green. They bloom during the summer, the blooms followed by rich orange red seed-pods, which are most ornamental; but if the blooms are allowed to mature, the season of bloom is checked.

"Climbing roses and the Rugosas must not be placed in the rose bed proper. The Wichraina and its hybrid Dorothy Perkins, are splendid for banks and trellis, magnificent as pillar roses and on arches. The Wichuraniana has star-like white blossoms, with a delightful fragrance; its foliage is its chief beauty, with leaves about the size of the leaves of the smilax.

"The Dorothy Perkins is a beautiful shell pink, fragrant and full, blooming in clusters, late in June. The growth is exceedingly strong, foliage glossy green, retaining this appearance all summer. I cannot say too much in praise of this rose."

Tea-Roses.

The hybrid tea-rose is hard to raise in the north, but it can be successfully grown if much protection is given.

To be most effective the plants should be in masses of from 20 to 100 planted together, all of one kind in a bed. They should be about 18 inches apart, making about 12 plants in a bed 6 feet in diameter and 37 plants in a bed 10 feet in diameter. The hybrid tea and polyantha roses should be planted in the spring in the north and the hybrid perpetuals in either spring or fall. Each spring the plants should be pruned, the dead wood being cut back and the remaining shoots cut

back four or six eyes. When planting, cut back the shoots to two or three eyes.

Among the best of the tea roses and hybrid tea roses are the Kaiserin Augusta Victoria (very tender), white; La France, pink; Killarney, flesh tint; Helen Gould, cherry red; Perle des Jardins and Betty, yellow. Pink Maman Cochet and White Maman Cochet are a beautiful variety, remaining in good condition long after cutting. All tea roses are excellent as giving freely of cuttings for the house during the summer. Most tea roses are best cut when about three-quarters open.

The following list of roses for a northern climate is taken from a valuable article on rose growing, presented by J. M. Underwood, of Lake City, Minnesota, at a meeting of the State Horticultural Society. This list has been chosen because it comes from a practical gardener accustomed to a northern climate and is therefore desirable for other localities, as well as reliable.

Hardy Roses: Cinnamon, Old Blush, Wild Roses, Scotch Roses.

June Roses: Magna Charta, Madame Plantier, Harrison's Yellow, Persian Yellow.

Rugosa Roses: Alba, Rubra and Madam G. Bruant.

Moss Roses: Scarlet, Crested, Princess Adelaide, Countess de Murinais.

Climbing Roses: Prairie Queen, Crimson Rambler, Baltimore Belle, Gem of the Prairie, Seven Sisters, Dorothy Perkins.

Hybrid Perpetual: Jacqueminot, Paul Neyron, Margaret Dixon, Alfred Colomb, Ulrich Brunner, Mrs. John Laing, Marchioness of Londonderry, Anne de Diesbach, Frau Karl Druschki, Mabel Morrison.

Rose Pests.

Roses are very subject to various pests. The best way to keep them away is to keep the plants healthy by manuring and cultivation. If the thrip lice or fly appears, syringe the plants daily with a solution of tobacco stems; 1 lb. of stems to 5 gals. of water; or, a solution of whale oil soap, 1 lb. of soap to 8 gals. of water, until the insects are conquered. The rose bugs, which work at the flowers, must be picked off. The presence of the rose caterpillar can be detected by its glueing two or more leaves together to form a shelter. Such leaves should be promptly pressed together with thumb and finger. Insects which eat the leaves can be destroyed by a mixture of white hellebore and flour, half and half. Sprinkle when the foliage is damp.

Scale will attack stems and twigs. For this, a very weak kerosene emulsion applied early in the season may save from any further attack during the summer. Rose lice—tiny, bright green insects—sometimes make their appearance in a twenty-four hours, in great numbers. Kerosene emulsion, or whale oil soap, sprayed on so that it will get on the under side of the leaves, are either of them good remedies.

Rose bugs and beetles can be killed by poisoning the flowers and leaves with Bordeaux mixture and arsenate of lead. Make a thick

lather of common kitchen soap and drop the lather with the hand on all the affected plants, till they are one mass of soap suds. If the leaves or roses mildew or rust, apply Bordeaux mixture.

Rose-Jar.

An old and tried New York recipe for a rose jar is this: Gather the petals every morning, and after the dew is dried, place the petals in a large glass jar, sprinkling salt over half-inch layers of the flowers. Add to these each morning until you have enough, letting them stand in the jar for ten days after the last are put in, stirring the whole every morning. Have one ounce each of cloves and allspice, coarsely ground, and as much stick cinnamon, broken and shredded fine. Transfer the flowers to another jar and scatter the spices mixed together in layers. Cover the jar tightly and let it stand in a dark place for three weeks. Have ready one-quarter ounce of mace and one-half ounce of allspice and cloves, all coarsely ground—or pounded in a mortar—half of a grated nutmeg, one-half ounce of cinnamon, broken in bits, one ounce of powdered orris root and one-fourth pound of dried lavender leaves. Mix these together in a bowl and proceed to fill the rose jar with alternate layers of the "stock" and the mixture of spices. A few drops of several essential oils—rose, geranium, bitter almond and orange flower are good—should be dropped upon the layers as you progress. Over the whole pour one ounce of some favorite toilet water. This recipe is sufficient to fill two quart jars or one large one, and will last for years. The jar should have a double cover.

The Best All-Round Greenhouse.

From "Garden and Farm Almanac"

The best type of greenhouse for all-round purposes is unquestionably what is known as the even span—that is, a house in which the roof is in the form of an inverted V, so as to be exposed as much as possible to sunlight, and having the ridge-pole in the centre. All other types of houses are modifications from this simplest form, and are designed in some way or other to fit some special requirements. These requirements may be: the cultural necessities inside, more or less abnormal at given seasons (as in a forcing house); or an adaptation to some peculiarity of the situation, as when a greenhouse is built as an adjunct to other buildings.

It is plain common-sense that the ideal greenhouse is one in which the light is most nearly that which exists outside, and in which the heat is as evenly distributed. It is practical experience that a structure with as few angles and turns in it as possible, and with a minimum of woodwork in its superstructure, best answers these conditions.

From the earliest days of greenhouse construction, the line of development has been toward a reduction of the timber and an increase in the size of the panes of glass, until today the accepted standard of size for the glass, where the question of snow-weight is not a serious one, is sixteen inches wide. Even larger sizes are used in the best style of modern construction, and panes 24 x 24 inches are quite

popular in commercial buildings, and there is apparently actually less breaking in the larger sizes; 16 x 24 inches is a popular size. The weight of snow, however, is not a very serious problem, except on flat pitches if the inside temperature is kept to about 60 degrees. Of course, the larger the pane, the greater the light inside the house, and the more natural the growing conditions of the plants, but as an offset to this is the expense of the larger sizes. Not only is the loss for repairs greater, but the ratio of cost increases very greatly in the larger sizes. It is impossible to make a quotation on the price of glass. It fluctuates almost as much as Wall Street securities. Sixteen-inch glass, or even fourteen-inch, will be found thoroughly practical and economical in use.

The Sash Greenhouse.

The cheapest form of practical greenhouse is made by using hotbed sash supported on a skeleton frame, from which they can be removed entirely in summer time. The standard size for the sash is 6 x 3 ft., and the house can therefore be made in any multiples of three feet, as regards length. The width of the house is governed by the pitch of the roof. Using two sash for an even span, the ends of the sash supported by a central ridge-pole, a width of about ten feet would be had, giving the pitch to the roof a rise of about seven inches to the foot. Such a house can be built for very moderate cost. The lumber for a house may be estimated roughly at about $3 per lineal foot, and the glass at $1.50 per foot. Carpentering and other labor will vary from $2.50 to $3 a foot; and together with heating a house of this style twenty feet long, may be erected for possibly $250. If iron frame is used, instead of all wood, there is greater durability, and the structure being more slender, will admit more light, but the cost will be increased by perhaps $100.

Comparative Costs.

It makes very little difference what form of house is to be erected. The cost per lineal foot for an even span is practically the same as for a lean-to of the same length and width. In the lean-to, in order to get the sufficient bench and walk space inside, it is necessary to carry the roof to a point much higher than in the even span house. The extra framework and material for the roof cost a good deal, yet add practically nothing to the efficiency of the house.

The three-quarter span house, which differs from the even span, in having the ridge nearer to one side, and a short span from there down to the top of a high wall is equivalent to a lean-to with a few feet on the top cut off and turned over. It is a practical house for fruit trees particularly, where the main object is to maintain a slight degree of forcing. Such a house should stand with its exposure to the south; in other words, it should extend east and west; the object being to secure as much of the sun's heat as possible rather than abundance of light.

For ordinary plants, such as the amateur will grow in a general collection, a lean-to is not so well adapted as the even span because

the illumination being all from one side, the plants get drawn in that direction, just the same as they do in the ordinary window garden.

Where the glass structure is designed for ornamental purposes as much as for utility, what is known as the curvilinear roof is very popular because it does away with the straight lines and sharp angles which characterize the simple greenhouse. The curved line adds a degree of beauty, and where this is an important consideration, a little of utility may be sacrificed for the sake of art.

The Roof Pitch.

Greenhouse builders vary the degree of pitch of the roof up and down from 7½ inches to the foot, but it is always somewhere around that figure, which is equivalent to an angle of 32 degrees. This angle allows the sunlight to pass through the glass most directly for the longest time during the day, together with accomplishing the very desirable object of quickly shedding the snow. A roof that approaches the flat presents a big problem in winter, and artificial means may have to be resorted to in order to remove the snow and admit light to the growing plants, but its most serious objection is the impossibility of making it tight—it will surely leak. A pitch of six inches to the foot is as low as should be built. A much higher pitch, while solving the snow and leakage problems, results in a great loss of light at the times of year when the sun does not rise very high and when it is most needed.

In the curvilinear roof there is always some one portion, it is true, at which the sun's rays strike at right angles, but in by far the larger portion the glass is standing at all variations from that to the perpendicular, when practically no light is passed through. Another objection is that this very pretty roof is certainly 10 per cent more costly.

The Direction of the Sun.

There is a division of opinion as to how a house should be placed in relation to the sun. One that is built entirely of glass should perhaps best run north and south. It is evident that this will give the greatest exposure to the sun during the longest numbers of hours, both sides receiving illumination at some time during the day. The small end of the house to the north is the only portion that does not receive the sun directly.

For this very reason, it is better to select a south wall of a house for the ordinary conservatory, or lean-to greenhouse, when such is erected in connection with the dwelling. The north side of such a house has no glass whatever. Most florists, however, are now placing their carnation and rose houses east and west.

The Commonest Blunders.

The chief mistakes which the amateur is likely to make in constructing his own greenhouse are these:

1. Insecure framework.
2. Too heavy lumber and other than cypress.

3. Incorrect pitch to the roof.
4. Lack of economy in internal space.
5. Skimping the walls and foundations.

Perhaps the last is the most common of all, and when the winter comes, the problem of maintaining a proper growing temperature causes more anxiety than the whole crop of the house is worth. A greenhouse must be built for winter; it is not an uncommon sight to see an otherwise very pretty and satisfactory little house which has to be boarded up and packed all around the foundations with some heat-retaining material, so as to keep the inside comfortable. The saving of perhaps $100 or even less, at the very beginning of things, thus results in an annual expenditure in hard cash of perhaps $10 or $15 and always with the risk of the weather being just a little bit more severe than usual, and the result being a total loss of the most valuable plants.

The Question of Width.

The standard widths for greenhouses are 6 feet 8 inches for a lean-to with one bench, and 9 feet 4 inches for a lean-to with two benches, and a central walk. The difference in width which gives the extra bench is very slight and the cost for twenty-five feet is for the single bench $450, for the double bench $700. An even span house 9 x 17 ft. all wood frame, boiler and heating complete, can be erected for $500.

Heating the House.

In a greenhouse in which a general collection of plants is to be grown it is necessary to maintain a temperature of from fifty-five to sixty degrees, when it is zero weather outside. Lettuce and violets may be grown in a house which runs ten degrees lower than this, but no one should build a greenhouse of the ordinary type, and calculate on maintaining a lower degree of heat than what is here given.

Heating is best done by hot water, and in a small house the pipes may well be connected with the heating system used for the dwelling, if the greenhouse and the home are within any sort of reasonable distance from each other. For large houses or ranges of several houses together, the independent heating plant is necessary. Steam is used for heating by commercial florists, but it is economical only on a large scale. As a uniform degree of temperature must be maintained in the house, the fires, where steam is used, need watching continuously during cold weather, for the moment the water ceases to boil, the pipes cool off, and some considerable time is consumed in starting the heat running again. With hot water there is much more latitude in attention, for though the fires dwindle, the water which fills the pipes will carry heat for a long time, and it will circulate until the last degree is radiated. But a hot water system costs in the installation about one-fourth more than steam. Very small houses may be successfully heated by kerosene stoves, which may be placed inside the house. The fumes which may be given off are not likely to be seriously injurious to plants. A much better way would be to use oil heaters for an inside water circulation, carrying off all products of

combustion by means of a flue. Coal stoves should never be installed inside the house. It has been done successfully by some amateurs, but the danger of coal gas being driven back into the house by a down draft in the chimney is always present, and is too great a risk to run. Coal gas and illuminating gas are two virulent poisons of plants.

Figuring the Heating.

How to maintain a minimum of 55 degrees? It's quite easy to know what to do. Find the area of your glass surface in square feet, and allow one foot of radiating surface for every three feet of glass. Walls up to two and one half feet high are generally ignored in making the calculations for heating. If they are anything more than this, allow one-fifth of the area as equivalent to glass. Heating is usually laid on by 4-inch (outside measure) cast iron pipe, if water is used, and one lineal foot of this equals one square foot of radiating surface.

Another commonly used size is 2-inch wrought iron, of which 1.6 lineal feet is equivalent to one square foot of radiating surface.

Having ascertained the amount of radiating surface necessary, it is an easy matter, upon reference to the catalogues of greenhouse builders and boiler makers, to decide upon the capacity of the boiler to be bought. These details are all tabulated.

Though as a matter of fact it may be taken for granted that the maker's statement represents slightly under the full efficiency of the boiler, yet there is nothing like having reserve power, and the amateur who wants comfort in his greenhouse, and comfort in running it in heavy weather, will purchase a boiler which is listed to feed at least 25 per cent more area than he really requires. There is not only reserve power for unusual strains but a big, deep fire can be operated with so much less labor, and actually during the winter months, with a less consumption of coal than would be the case with a boiler that was piped to its full efficiency.

CHAPTER XV

Bees

BEE keeping is a profitable business if the bees are rightfully cared for. The bee is the wisest of the wise among the animal kingdom. He rises early, flies afar to the hills and loads himself with the finest of the sweets that the land affords. Day after day he grades these as he gathers them, putting the beautiful white clover honey by itself, the basswood by itself, and the buckwheat flavor has its own place. Selecting and arranging in this orderly fashion he continues through the season of bloom, going miles often for honey. As a co-worker on the farm, he is an excellent aid to the pollenizing of fruits, and as a syrup and sugar factory he is a marvel of mechanism and industry.

Bee keeping, in order to pay, must be conducted on simple, cheap, but effective principles. A safe rule for the beginner is to buy only such fixtures as he cannot get along without. An extension ladder to get a swarm of bees down from a tall tree is better than any swarm catcher on the market. If one does not "fuss' too much a good many bee colonies can be taken care of on a farm without neglecting any of the farm work. On a poultry farm, bees can well be kept, as the hardest part of the bee work comes when poultry work is comparatively light. The most important thing to remember in bee keeping is to make them pay for themselves as you go. Begin small, and increase only as you can see that it will pay to do so. Then you will not pay too dearly for your experience. Yet bees must have systematic and consistent attention. The writer has seen 150 to 200 colonies put in the cellar in November, and the same number taken out in April, alive and in good shape for work.

The Essentials.

Three essentials were necessary for this: a good queen, not more than one or two years old (a queen from the present season's raising is still better); an allowance of from 25 to 40 pounds of honey, according to the location, to each colony, or of sugar syrup; and a good cellar, free from damp, with a temperature that does not vary more than two or three degrees during the winter. If the covers are removed, and this was the method followed in this instance, the hives are better ventilated. But the frames must be covered with good, heavy ducking just after supers have been taken off. This allows the bees to seal down the cloth, and gives a bee tight cover when the board is removed.

Spring is the best time to make a start with bees. If you are a beginner, and don't know a good colony from a poor one, bargain with a neighbor for the first swarms that issue. The early swarms yield a

good lot of honey, at least enough to pay for the bees, and they are sure to have the most prolific queens, which means thousands of workers for the season. Of course, you will inspect your bees before buying; and equally, of course, you will inspect the hives you buy. Get good moveable hives first—the kind that are loose from the bottom boards, fastened on by two hooks and staples on each side. In hot weather all hives need to be raised for ventilation, and the bottom board should be cleaned often. A good, strong colony ought to weigh at least five pounds, which would mean about 12,000 bees. Face the hives south or east, and near a good hedge of evergreens, fruit trees or grape trellises as a protection both from too much wind or too much sun. Never open hives when the early spring day is too cold for bees to be flying freely. In moving bees from one location to another be careful not to smother them by too close confinement. Bees readily adjust themselves to a new location.

Protect the Hives.

A double covering on windy days is desirable, so that late snows or cold rains may not chill the bees. If you can't do any better, turn a big box over the hive. Be sure to first saw out a little opening that will correspond with the opening of the hive, so that the bees can get fresh air, and so that they can take little flights as the weather warms up. A big box, even without chaff, is a great warmer. If tight at the bottom, so no wind blows in, it gives a chamber of dead air, and that is a good non-conductor.

Remember that the bees cannot get honey even on warm days of early spring, except from soft maple blossoms and willows and dandelions. In late spring warm weather one bee keeper feeds syrup in a large trough at one side of the apiary, using corn cobs or sticks of wood for the bees to alight upon. All spring food must be as thin as water and quite warm. A little experience will tell one very soon how to know when the hives are keeping in good condition. If flying bees are active in May in normally good weather and if there are plenty of bees with pollen on their legs going into the hive you can reasonably conclude that the inside of the hive is doing as it should.

Shipping Bees.

About May 1st is the best time to buy or sell bees or ship them. In buying bees get good Italian bees in movable frame hives. Get hives heavy with bees, without caring much about the honey weight. See if the cluster nearly fills the hive and if the combs are straight and built in the frames. In moving bees by wagon or shipping by railroad, do it in April or May. The frames are probably fast with propolis, and by nailing a wire screen over the entrance early in the morning, before they begin to fly, the hives are ready for removal. Look the hives over first for cracks and secure the honey board down by nails or screws. The combs are tougher at this season, the honey less, and the bees fewer.

Moving in warm weather needs much care. The bees are likely to create a great deal of heat by their agitation, enough to melt the

combs. These will fall and smother the colony. It is best to remove the two outside combs if very heavy with honey, and put in some dry and empty ones or some with cold water in them. Also remove the honey board and tack a wire screen over the whole top, protecting it with strips of cloth. This will give upward ventilation.

Summary for General Spring Treatment.

I give a summary for treatment of bees generally, as soon as spring management can be thought of and the bees are out of the cellar. Of course, you have kept an eye to the stocks and as to the supply of honey. Do this by raisng the honey board, puff in a little smoke and look for sealed honey. If none is in sight a further examination is needed. If no honey is found it will be necessary to give feed. Make it of granulated sugar and half water and sugar, boiled until dissolved, cooled to blood heat, and then feed. Use the pepper box or suction feeder, which can be inverted above a colony and from which they can eat up clean without draggling themselves. Maple sugar is good for bees and a pure New Orleans syrup—not a purified one—will be eaten by the bees. Do not feed if the hive has plenty of honey. A teacupful of syrup every other evening is enough for a large colony, unless continuous breeding is going on, when a teacupful every evening should be given. During April and May this is very important. Often even in June there will be a cold rain. The bees can get no honey and the lack of sufficient feeding makes such inroads by the young bees on the honey accumulated that the colonies have starved. The bees often eat their own larvæ then. Therefore be sure to look well after the feeding question.

Bees require constant management of this sort in order to make them profitable. Bees left to do as they please will swarm three or four times in the season, requiring many hives and thus greatly adding to the expense. This can be prevented by giving additional room at the right time, before the bees prepare to swarm, but not before honey begins to come into the hive. If the extra supers are put on too early they may hinder brood rearing. But if too late, and the queen cells are started, it is almost impossible to prevent a swarm. Give the extra supers at just the right time, when as many as fifty bees are coming out per minute and are showing much activity. Give good ventilation, also, and shade the hives in the middle of the day and you can control swarming to a great extent. Some bee keepers take out their queens in June, not allowing the bees to swarm at all. By this method the storing of a large surplus of honey goes on.

"It is well to keep watch and try to find out what flowers the bees are working on and notice whether or not they are bringing in honey. By lifting the honey board or cover board it is easy to see whether they are getting more than is needed by the increasing brood. If honey can be seen in the top cells and bits of white new comb are being built on top of the frames, put on the supers at once. But you can't do these things in the nick of time unless you have supers ready."

The first day after being set out of the cellar in the spring, bees are eager for water and large quantities will be brought in. Open the

entrance wide the first day so that all can have a free chance to fly and clean out the hive of dead bees, but on the evening of the first day contract the entrance with blocks to two inches. The bees will be better able to protect themselves from robber bees and to keep warm. Don't leave bits of honey about the yard at this season. The bees taste it, and it excites them with the desire to rob. The strong bees will then get stung to death from robber bees and the weak will be overpowered.

Soon your bees will begin to show the results of good care in the spring if they went into winter hibernating with a young queen, who is now laying eggs and has been all through the spring. The bees will be flying far, and all this outside bustle will mean combs in the hive filled with capped brood, larvæ and eggs, and plenty of bees to darken them. At the same time enough honey for food and surplus is being stored along the top bars or the corners of the frame. Your bees are on the job again.

Safe Wintering.

The most important part of the bee keeping is their safe wintering. If the bee hives have been managed during the summer according to the previous directions this will not be such a care as it seems. A good queen—not too old—for each colony, and plenty of late hatched bees, with good honey—(June honey is the best)—generally insure safe wintering, though the cellar must be dry. In states where the mercury drops to 40 below zero occasionally and stays below freezing for weeks at a time extra precautions must be taken as to cellar keeping. In mild climates outdoor wintering is generally practiced, but this method is more expensive as to preparations and the bees take more honey. A cellar gives the three most needed requisites for bee wintering, which are, absolute darkness, quiet and a temperature at about 50 degrees. If you can keep potatoes in good condition through the winter you can keep bees there.

For a cold climate the hives should be taken into the cellar on a dry day, sometime near the 1st of November. The hives should be raised from the ground a little, and racks on each side of the cellar, slanted one inch incline from back to front and strong enough to hold several hives placed above each other will be needed. Leave all upper covers outside and the entrance wide open for several days. Ventilate by an upward tube 6 inches square. Each colony should have about three pounds of honey per month during winter. Use no artificial heat, but simply make your cellar frost safe and regulate the heat by opening or closing ventilators. A cellar 8 feet deep, in a sandy soil, is the best. For such a cellar 40 degrees all winter is a safe temperature.

The more honey you can give your bees the better will be their condition in the spring. The success of your whole season will depend upon the strength that each colony brings from the winter confinement. They must have enough food also to keep them raising broods during April and May, for it is the early bee that gets the June honey plentifully for a surplus. Don't worry if you don't hear your bees

hum, and don't begin to bring the hives out of the cellar into the open air with the very first warm days. The bees are wiser than we. They don't hum because they know there is nothing for them to do yet, with no flowers open, and they would only wear themselves out flying for food. The queens also ought to be laying well by March, and if the broods get a chill by a change of temperature the colony is that much weaker. Stick to the cellar, at least in the 30 degrees below zero states, until warm weather.

Sweep up the dead bees once in two weeks in the winter. Brush them off from the entrance board to the hives, and dig them out from the bottom of the hive with a long, slim splinter. They must not be left to interfere with the ventilation of the bunched up colonies. Keep the bee cellar sweet and clean for the health of the family also, as well as for that of the bees. If a whole cellar cannot be given up to bees, in order to be sure of dark quarters, partition off a part with studding and building paper.

I will add here some directions as to arranging hives in the cellar, which are very exact and detailed and are given by a professional bee keeper. They are intended for a large number of colonies:

Arranging Hives.

"The proper way to arrange hives in the cellar is to put down scantling the proper width apart and nail with lath to keep them in place, using a spirit level to set them so that the hives won't 'teeter' when put in place. Begin at one end and set them down four inches apart, and after completing one row remove the covers and raise each hive off the bottom by two little blocks, ⅞-inch thick. This gives plenty of ventilation and allows a space for dead bees. Before proceeding with the next row, cover the first one with old carpet, grain sacks or any cloth that may be handy, placing on top of that a ⅞ strip the whole length of the row and at the rear of the hives. This piece is to equalize the blocks at the entrance so that the next row sits level. It also helps to bind the rows together so that they will remain perfectly steady if piled five or six rows high."

Don't take bees out of the cellar as soon as the snow is all off and a few warm days appear. In the northwestern middle states from the 15th of April to about May 1st is the best time. If you wait too long and flowers appear, the bees will fly too freely every day and get so much pollen that the queen bee will lay too many eggs and the old bees will have too much to do in flying and brood-rearing. This exhausts them needlessly and they die off before the young hatch out, as most of the eggs laid by the queen are laid after the hives are set out. About three weeks after being put out the young bees hatch, and by this time, if the hives are set out after blossom time, the old bees have died out so much that the outside combs of brood die or wither down to a small number. On the other hand, by setting out hives early on a warm day, the bees begin to breed at once. But after the first cold snap comes again the old bees stay inside and attend to the brood, there being no temptation to long flights. They thus keep the brood nests warm, and the young bees begin to hatch out while

the old ones are with them. The hive is much warmer and the young bees are saved until settled warm weather comes.

Clip the queen's wings in the early part of May. This prevents high swarming or wood nests. Open a hive without smoking, if possible, raise the combs quickly till you see the queen, catch her by both wings with the right hand, clip the thin gauzy part off one wing and set her back on the comb, closing the hive at once. This can be done as soon as a queen is laying and no harm done. Never clip a virgin queen, as mating is done in the air. If clipped she will never be mated. One mating for life is enough. In the spring great care should be used in taking bees out of the hives. They will chill if very near the ground. A little sprinkling of quite long straw, scattered on the ground close to the hives, is a good safeguard. The bees will fall on the straw and can crawl into the hives.

Bees in a Cave.

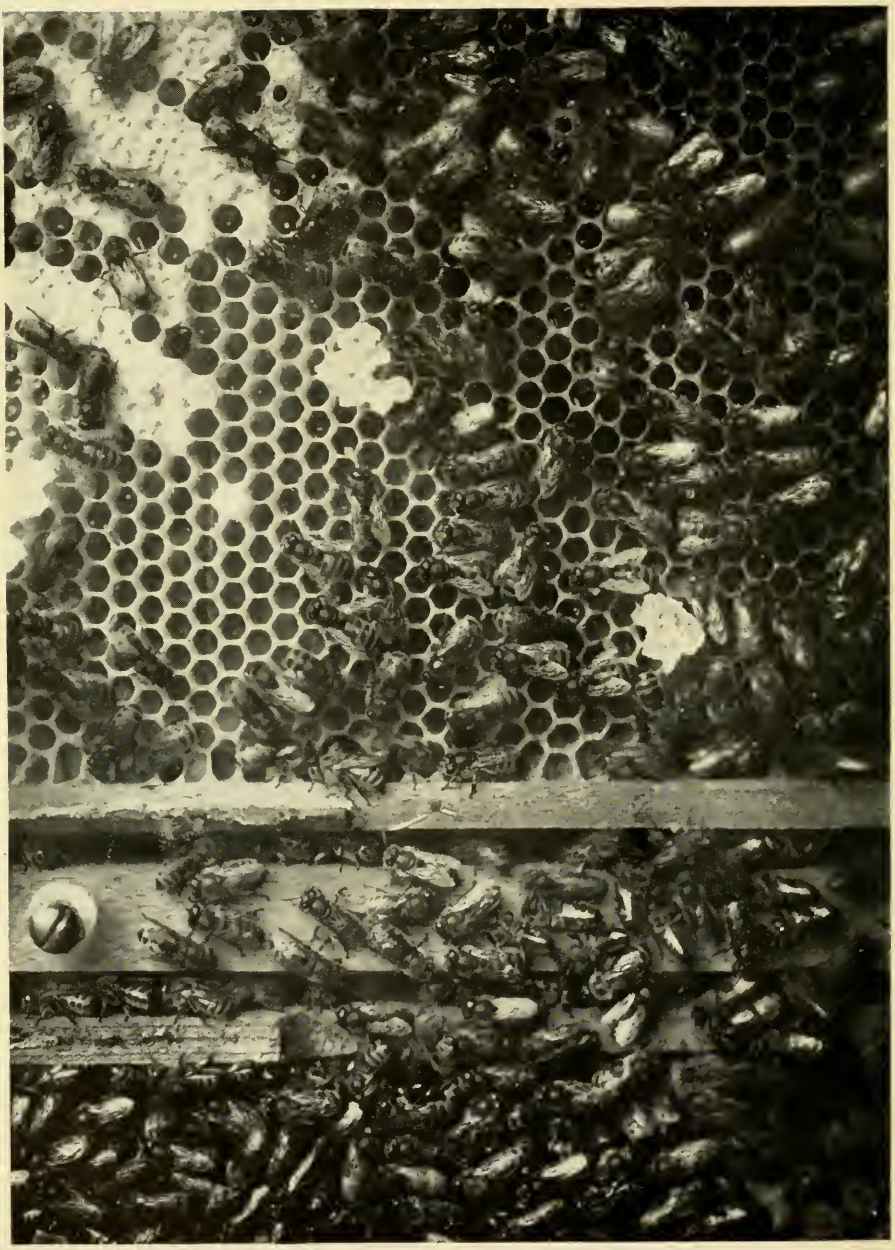
One bee keeper winters his bees in a cave built in a side hill. The cave is ceiled with stone flagging; and over this are several feet of earth which is kept dry by means of gable roof. Back of this cave, to the northwest, is a fence which causes the roof to be covered, in winter, with drifted snow. There are four doors to pass through, in entering the cave, thus providing three dead air spaces. It is hardly necessary to say that this cave is both dry and warm and is shielded from noises of all kinds.

In many of the middle states, bees are wintered outdoors with success, but in such conditions the hives are packed in outer protection, usually cases made from dry goods boxes. These cases should be painted dark to absorb as much of the sun's rays as possible. It is best not to fill in at the bottom of the case. An air space of a few inches is best here. For the rest of the air space use some good packing material, and have five or six inches of this on top. Do this packing on a day when the bees are able to fly. The opening in the winter case must be cut to correspond with that of the hive. For winter this should be contracted to three-eighths by three inches for good, strong colonies. For weak ones three-eighths by two inches is better. Anything deeper than the three-eighths inch will admit mice. The little field mice will even go through a less depth than this.

In southern and more temperate climates a good substantial hive with a tight roof will keep rain and snow from the colony when outdoors. Be sure to have a full width entrance, but no top ventilation in such cases. The bees must have air, but a draft is very bad. Have the entrances shallow and long instead of round.

Uniting Stock.

It is a good plan when uniting weak stocks with stronger, to choose a time when swarms begin to leave a strong colony. When the swarm is in the air, set the parent hive off the stand, put a new one with wax starters on this and hive the new swarm in it. Open the parent hive, shake the remaining bees down in front and let them run in with the swarm. The brood combs can be given to a small



Bees in glass case—making the comb.

colony with a good queen. This will bring up the weak stock rapidly, and in a week or so they will be making surplus honey.

February is a good time to get what extra hives are needed. Any man—or woman—handy with tools, can not only make their own hives, but some for the neighbors. If you can't do that, buy them in the flat and put them together. The old plain Langstroth hive is as good today as it ever was, and there are more of these in use today than of all the other kinds together. As to sections, the old style 4¼x4¼ one is practical and simple for the small bee keeper. Sections and starters are necessary if comb honey is to be produced for the market. But be sure to have these in the supers in plenty of time before the swarming season is due. If you get this surplus department ready before the rush of spring work is on at the farm you will be ready to meet the bee half way, when he is ready for work. It has been said truly that "a bee never begins business until he is thoroughly ready to carry it on, and then he never does it by halves."

Feeding the Bees.

September is the best time to feed bees that are short of honey to winter on. Inspect your bees the first of September. If there is less than from 12 to 14 pounds in the hive, stored compactly in the center of the brood apartment, for each swarm or colony, then feed them while the weather is warm. This will do away with the winter fussing and be much better in the end. The syrup must be placed in the hive so that no other swarms or hives can get in to rob. To do this, close the entrance but be sure that the bees have plenty of air. Never allow bees to enter winter quarters without plenty of stores for food. Syrup for winter feeding should be made much richer than that for spring feeding: To fifteen quarts of water brought to a boil, add thirty pounds of granulated sugar. Stir till all is dissolved, bring to a boil and skim. Cool and add three pounds of extracted honey, which prevents the hardening of the syrup in the feeders.

Another good way to make and feed the syrup is to bring to a boil two quarts of water and dissolve in it four quarts of granulated sugar. Boil and skim. Try a little in a saucer by stirring with a spoon until cold. If thick enough to cake it is ready to work. If not, boil more and try again. When thick, set in a cool place and stir till it turns white. Pour upon buttered plates in amounts that will weigh about two pounds, and let this harden into cakes. Lay these cakes on the frames above the bees. Keep the cellar at a temperature of fifty or fifty-five degrees, and the bees will winter as well as though fed honey. Great care must be taken not to brown or scorch the syrup while boiling, as then it will kill the bes.

Shipping Bees and Honey.

It is well, in shipping bees, to tack on a shipping card warning against letting the bees stand in the sun. In selling honey cultivate your nearest market before trying the big cities. Keep the honey on sale there the year around. It has been said that every town of one thousand people will consume a ton of honey a year if the producer

handles his market right. Not many farmers keep bees, and therefore even in a farming community there is a demand. At any rate, don't try the big cities until you have solicited your own home markets thoroughly. It is important to put your honey on the market in first class shape. Keep the honey in a very dry and warm place, especially the comb honey, or extracted honey. Grade the comb honey and bottle and label the extracted. Candied honey should be sacked. Have your own trade mark and never allow it to stand for an inferior article.

An Oregon bee keeper gives these directions for making sacked honey, or candied honey. This honey product can be handled and shipped with such ease that it commends itself to the man who keeps bees for profit:

"To prepare honey for 'sacking' it is first run through a straining machine and it might be added that comb honey not up to the standard makes a 'sacked honey' of first grade. After straining, the honey is placed in large vats and set out in the open, when the heat of the sun clarifies it. The vats are tightly covered that no dust or impurities can enter. The clear honey is drawn off after it has remained two weeks in the vats. It is then put in sacks and allowed to stand exposed to the air a few days. It then candies or solidifies, and is ready to be put in rolls for the market."

Bee Pests and Diseases.

Bees are no longer considered immune to disease. In fact, the germ question for bee keepers is almost as pressing as it is to the medical world and the human race generally. In this matter, though, it is just as true as with man, that an ounce of prevention is worth a pound of cure. Keep only strong colonies and then bend every effort to maintaining the strength of the colonies by proper winter care and inspection. Foul brood is becoming one of the most dreaded of bee diseases, as it works so insidiously that a whole apiary may be infected before the fact is known. Nearly everything hinges upon how well the bees come through the winter, and their well being at this time, granted that the hives go in in strong condition, depends chiefly upon three things: an ample supply of food, even temperature, and good ventilation, but no chills—eternal vigilance, in fact.

The wax moth is another pest of the bee keeping business. This moth is hatched from eggs laid by a brown miller, such as can be seen around hives in summer. As these eggs are always present in combs that bees are on during the winter, put all empty combs that are hung up or stored away in some place where they will be frozen all winter long and hang them with an inch space between them. If there is ample space on both sides of a comb it is seldom destroyed by the worms. The best way to protect from this moth is to keep your colonies strong and provided with a queen. In strong colonies the bees drag out every worm as fast as it appears.

Beeswax.

In making beeswax by home methods use soft water and bright tin ware or granite ware enameled. If possible do the work outside

the house or in some out building. Use great care as to boiling over, on account of the inflammable nature of the process. If you have a large quantity the wash boiler may be needed. Make coarse sacks of loosely woven material, put in the comb, pound them well, tie the sacks closely and lay on a piece of board laid on the botton of the vessel you use. Fit another board on top and weight down by heavy weights. Cover with water, boil slowly, let the wax cool over night and remove next day. Or, if you want to boil up more comb, skim off wax, and add combs, and water as needed. For clarified yellow wax, melt a second time, strain into a vessel with water in it with flaring sides. Put in oven and cool very slowly.

The "ABC of Bee Culture" gives a simple way of treating combs if you want a small quantity of bees wax.

"Take an old dripping pan and split open one corner. Put the bits of comb in the pan and put the pan in the oven of the cook stove, leaving its door open. Let the leaking corner of the pan project out of the oven with a dish beneath to catch the wax, and have the end of the pan inside the oven raised an inch. The heat of the stove will do the rest."

But the finest wax is produced by a solar wax extractor. This is a box lined with tin and covered with glass and placed in a sunny spot in the yard at such an angle as to get the direct rays of the sun. These extractors are sold by supply dealers at from $4.00 to $6.00, or you could make one if you saw a picture of it. I don't think they are patented.

One of these sitting in the yard, into which all the scraps and scrapings of the hives can be thrown, is a very handy and very satisfactory adjunct.

Bee Stings.

Persons with weak heart action should be very careful about exposing themselves to bee stings. The first thing to do when one receives a sting is to remove the stinger if possible. This should be scraped off at once, rather than pulled out with the thumb and finger, because the sack containing the poison is usually left by the bee, and as the stinger is a hollow tube, squeezing the poison-sack injects more venom into the flesh. Ammonia applied to the wound is recommended. Cold water will allay the pain.

If one is at work with bees and receives a sting, the best immediate remedy I have found is to smoke the part. As the lighted smoker is usually at hand it is easily applied. This destroys the scent left by the sting and other bees are not attracted by the smell to increase the dose. Wet soda, wet mud, or permanganate of potash, if applied at once, will, any one, be a good remedy. Most people become immune after handling bees for a few years, and the poison will not cause much swelling, though it will give as severe pain. An old bee keeper says:

"One must know when and how to handle bees, and when to let them alone. Because one can protect oneself by netting and gloves so as to be almost proof against stings, it is not wise to handle them at all times. Only extreme necessity will warrant it, because when

once stirred up at an inopportune time the bad effects may remain for a long time. If nectar is scarce and they have a tendency to rob each other, one must be careful when he opens a hive. At such a time, if necessary to examine them or to perform some operation, it should be done toward evening or when few bees are in the air."

Another good remedy for the sting of wasps or bees is to apply common table salt, moistened with a little water. Where a bee is accidentally swallowed, and the throat stung, the alarming symptoms that follow are instantly relieved by drinking copiously of salty water.

Among the honey-producing plants the basswood makes a honey of delicious flavor. Fruit blooms help the bee out in activity at honey-making; alfalfa, sweet clover, white and alsike clover, melons, canteloups, cucumbers and buckwheat are each of great value and can all be grown on the farm. The second crop of red clover is also sometimes visited by the honey bee, but in the main the bumble-bee is the chief pollenizer of red clover. Unless the second crop of red clover has been dwarfed by dry weather, so that the nectar tubes are shorter, the honey bee cannot reach the nectar.

The Life of the Bee.

[The following description of the life of the bee was written by Mrs. Barnes of Hamline, Minn., who knew the writer and contributed this most interesting article to this volume.]

It is an impossibility to give a full description of the life of that most wonderful little creature known as the honey bee in a few brief pages, since a whole book could be written on the subject. So we have gathered together some of the most important facts and will endeavor to give them in such condensed form as these pages will allow.

The bee hive may be compared to a city containing from 20,000 to 60,000 inhabitants, whose houses, having no windows, but only doors opening into them, allow each owner to enter, and are just large enough for this and no more. These houses are very evenly built, with here and there a few royal palaces larger than the others, for the queen and princesses. Some of the common houses are used for the storage of food in the summer to feed the inhabitants, and still other houses that are occupied only to live in during winter. Although the doors remain open, none of these little citizens ever leave home, except to perform different duties which are done in the proper time, in an orderly and law-abiding manner, thus causing no friction whatever in the upbuilding of this wonderful city.

One queen reigns over all, and she also makes herself useful, obeying all the laws that concern her work and life among her subjects.

And so thousands of these little creatures are busily engaged from sunrise to sunset passing in and out through the door (just large enough for two to pass each other). Although all seems to be disorder and confusion, yet each one is doing her own appointed work and perfect order reigns over the whole.

And now for the way these interesting little workers of this strange and wonderful city go about their daily duties:

A cluster or swarm of bees may be procured on some sunny morning in May, by going into a country garden, where they will sometimes be seen hanging in a large bunch to the bough of an old apple tree. Many thousands thus hang together, by each bee clinging with its forelegs to the hinder legs of the one above it. They would, if left alone, soon find a home in some cavity or shelter somewhere and begin to build a honey comb, but wishing to obtain their honey we will bring a hive, hold it under them, and shake the bough gently so that the bees fall into it, whereupon they will cling to the sides as we turn it over on a piece of linen on the stand where the hive is to remain. Almost immediately the industrious little insects will arrange to make their new home. There are the drones or males, large and dark, who never do any work during their whole lives except on one or two days; the small working bees or barren females, and the queen, blacker than the rest, having a long body and short wings, and which is the fertile bee.

Some of the working bees fly off in search of honey. Others see that all cracks in the hive are filled up (they do not like the light to get in), using a sort of gum called propolis, which they gather from plants having sticky buds. Others again cluster around the queen, for she must be watched and tended, while the largest number begin to hang in a cluster as when found on the bough of the apple tree. Presently one bee settles on the ceiling of the hive and turns round and round to make room for herself to work in, then with her fore legs she brings a scale of wax from a sort of pocket located under the abdomen, and holding it in her upper jaws she bites and moistens it with her tongue, forming a paste which she draws out like a ribbon and plasters on the top of the hive. She will do the same thing again until all the wax is exhausted, for she has eight of these little wax pockets. Then she leaves a small lump of wax on the bar stretched across the ceiling, and flies away from the hive. So, one after another, will the rest of this large number go through the same process, till a large wall of wax has been built, hanging from the bar of the hive.

By this time the honey gatherers are returning laden with honey. But no cells having been made yet, they just hang quietly onto the other bees, remaining thus about 24 hours, during which time they digest the honey, part of which forms wax, which oozes out from the scales under their body. Then they are ready to help plaster wax on the hive with the other bees. When a rough lump of wax has been formed, another lot of bees who nurse and prepare cells for the young ones, come to do their work, which consists in forming the base of a cell. This is done one after another, the same work proceeding on the other side of the wax, so that a series of hollows are made back to back all over the comb. Then the bees form hexagonal tubes about half an inch deep upon these hollows, making them ready for the honey or bee eggs. The work is so well done that the tubes fit into each other perfectly and not a bit of space is lost, besides making a warm house for the young bees. One comb being finished they proceed to make another leaving a path just wide enough for two

bees to pass back to back. Thus do they keep busy until the hive is full of combs.

When a few of the cells are made, the bees laden with honey begin to store it. They gather it from flowers by means of a sort of long tongue or under lip which is thrust into the flower and a drop of honey sucked out. This is swallowed into a honey bag or first stomach lying between the throat and real stomach. When she is ready she can empty this bag through her mouth into the honey cells.

The bee also gathers pollen from flowers when they are moist with dew, or else from some moist, shady place, if the dew has disappeared, and packs it in the joints of her hind legs, making them look like swelled joints. On arriving home the nursing bees take this pollen from them, and eat it themselves; also mix it with honey to feed the young bees. Should there be an overabundance it is stored away in old honey cells. Sometimes it is found in a honey comb. It is bitter, and is called bee bread.

When the bee is relieved of the bee bread, she stands on the edge of one of the clean new cells and throws up the contents of her honey bag into it. Thus the busy bee must continue to be indeed very busy day after day in order to fill all the cells, which, of course, remain uncovered, the honey being too thick and sticky to flow out, and is used every day for food. Should there be more than a sufficiency for daily needs, they close the cells with wax for winter use.

A day or two after the bees are settled in the hive, the queen mother, which has been kept closely in-doors, is allowed to come out now and do as she wishes. So she goes in and out for a time and at last soars away. All the drones follow forming an escort wherever she goes. She soon returns, however, and all the working bees gather around her on her arrival knowing that she will now remain and proceed after a day or two to spend all her time laying eggs. Many cells being now ready, besides those filled with honey, she begins to lay an egg in each one of these quickly, until she has visited all the cells on both sides of the comb, laying sometimes as many as 200 eggs a day. A few days after, about two or three, the eggs have become a tiny maggot or larva, and the nursing bees having prepared the bee bread mentioned before, place a little in the cells in which the larvae lie. Then in five or six days the larva has grown so well that it almost fills the cell, when the bees cover the opening with a thin layer of wax, leaving a small opening in the center. The larva then gives out from its tongue a whitish film like two threads of silk glued together. With this it spins a covering all round itself and remains about ten days more.

About twenty-one days after the eggs have been laid, the young bees having become perfect, begin to eat their way out. The nursing bees then stroke their wings and feed them for a day, when they will be ready to begin work with the rest of the bees. Their number is legion now, and the work of storing honey and pollen dust is carried on rapidly. The empty cells where the young bees have been are cleaned out by the nurses, and these also are filled with honey, this

being darker than that stored in clean cells, the latter being called virgin honey because it is so pure and clear.

In six weeks the queen begins to lay, in larger cells, eggs from which drones will come in about twenty days. Meanwhile the workers have been building cells on the edge of the hive with the open side upward, and about every three days (a fact for which there is good reason, as we shall see later), she stops laying drone eggs to put an egg into one of these cells. These eggs are given a special food, being a sort of sweet, pungent jelly, and strange though it may be, it seems to be the peculiar food and size of these cells that make this larva grow into a queen bee, as such is what these cells contain. For if they ever lose their queen the workers take an ordinary worker egg and put it into one of these cells, feeding it with jelly and it becomes also a queen. These also spin their covering, but instead of covering themselves entirely as do the other larvae, they leave a hole at the top. In sixteen days the eldest princess is breaking her way out of her cell, causing the old queen to become very uneasy, for she knows there cannot reign two queens in one hive. So, on a bright, sunny day—they will never choose a wet or cloudy one—she, with many of the others who have clustered together with plenty of honey, will start to find a new home elsewhere. A large number of drones also go with her, and they form a compact swarm, ready to begin again, as was told in the first part of this writing.

Now the new princess is reigning in the old queen's place, and the working bees crowd around and are profuse in their homage to her. About three days later, another princess is about ready to come out and the present princess proceeds to follow the same method carried out by her mother. She goes, taking an after-swarm with her. And that is why the princess eggs are three days apart, that there may be time for the first to get away before another comes. Now a third queen begins to reign, and should no new swarm wish to start she will proceed to kill the other princesses while yet in their cells until no more are left. Then she is satisfied, for she can then rule unmolested. A few days pass by, and she soars into the air with the drones, then comes home for the winter.

Now the drones being of no more use, the workers begin to kill them all off, keeping on until not one is left, not even a drone egg. They have no stings to defend themselves with, so they are soon destroyed. However, they could not live long if left alone, for the worker cannot afford to feed idle bees.

All that remain now settle down to feeding the young bees, and storing their winter's supply. About this time we can begin to take their honey, which sometimes amounts to as much as thirty pounds in a well-stocked hive, without depriving them of their own needs. But, in return, we should often feed them with some sweet syrup late in the fall and early in the following spring.

A certain number of bees now begin to ventilate the cells, the air of which has become very impure after so many bees have been packed together so closely. The way this is done, some bees stand with their faces to the entrances, and opening their wings wave them to and

fro. Others inside do the same thing, and a current of air is thus produced which ventilates the hive. Another lot of bees clean out the cells that were occupied by the young bees, making them ready to receive honey, and, again, others keep guard at the entrance of the hive against the destructive waxmoth which tries to lay its eggs in the comb that its young may feed on the honey.

There are many insects that trouble the bees, trying to get into the hive, and if perchance any do happen to evade the guard a fight ensues in the hive and the intruder is stung to death. Very often in such cases a pestiferous insect's body is too large for the bees to remove, so the clever little bee, in such a predicament, will bring the gummy propolis and cement the dead body all over with this, thus preventing it from decaying.

The wonderful life of the working bee is about eight months, all of which time she has spent most industriously. Only the bees born late in the season live on till the next spring to begin their work then. The queen bee lives about two years, having produced thousands of young bees in that time. So much for the bees in the hive.

CHAPTER XVI

Poultry

The Hens Lay Ev'ry Day.

We need a year to grow a pig,
'Tis two before a steer is big.
The hens lay ev'ry day.

Alfalfa takes three years to spread,
A horse as colt four years we fed.
The hens lay ev'ry day.

A few weeks yield the honey store,
Then blossom, fruit and all are o'er.
The hens lay ev'ry day.

For other things, too long we wait,
Our life is short, and payday late.
The hens lay ev'ry day.

—Ida E. Tilson.

YEARS ago poultry and eggs were listed as at the head of the seven great industries of the country. The 1910 census gives the production of eggs in that year as nearly fifteen hundred millions of dozens, while the production of poultry was over two hundred and fifty million of fowls of all sorts, three months old and over. This fact, so simply stated, shows that there is money for somebody in the poultry business in this country, even though failures are common, and though it has been said that where one person succeeds a hundred fail.

But pay no heed to the knockers, if you are willing to try what scientific attention to the hen can do for success in this business. For, in poultry business, as in everything else, more depends upon the man than upon the poultry. One man with a small capital and no experience may succeed, where another with a little experience but much capital will fail. A dozen fowls to start with, and a determination to go no farther in enlarging your poultry yard than your results and experience will warrant will usually end by bringing satisfaction and at least fair profits to the farmer or professional poultryman; for "eggs is eggs," and the demand is still greater than the supply.

That system of poultry housing which keeps the chickens always confined in small coops and yards, so that a large commercial business can be carried on in your back yard, is gaining a good many followers. But it can only succeed by the strictest attention to the feeding and management of the flocks, and the labor it requires, if only for the

necessities of cleanliness in a neighborhood is great and nerve taxing. The expense of establishing the plant is considerable, and unless one has fully resolved to make a continuous business of poultrying the close confinement or colony method is not always a triumphant success.

Remember the financial advice of some years ago, "The way to resume is to resume." There is no royal road to profit in poultry keeping. It is all a matter of good breeds, good housing, good care, and good food, and an unremitting attention to details, especially in zero weather. The poultry business is still in its infancy, and offers a field for the closest study—and until a man has had actual experience in the business he can tell nothing as to his profits.

Begin With Economy.

Begin in a small way, therefore, as I have said, and gradually extend your poultry department until it is as large as your farm will stand. Let the first year's work be largely one of experiment. Women are apt to make good poultry raisers, because success in this business is chiefly a matter of good housekeeping. But on account of the steady, hard work and close attention needed for hens and hens' quarters it is almost impossible for the farmer's wife to give the necessary time and labor to the problem. However, by a co-operation of farm forces, with a smart, capable woman at the helm, poultry raising can be made both profitable and pleasant to the farmer's family without drawing too much upon the field working forces of the farm life.

Where fruit culture is possible the union of the two industries is a good policy. First visit a successful poultry plant, study its methods, and see how they can be adapted to your own location and surroundings. In the east large families get a good income from an acre or less by keeping bees and hens, and raising fruit. The bees distribute the pollen when the fruit garden is in bloom. The poultry pick up insects in the plum and apple orchard and the small fruit garden. The droppings from the henhouse, with a pint of salt added to a bushel of the manure, are piled up outside the henhouse and later spread thinly over the ground or over the snow in the winter time. Poultry droppings furnish the most valuable of manures for fruit or orchard purposes or for grass culture. I know of one New York farmer who considers poultry manure of more value than commercial fertilizers for onion raising. It is especially good also for asparagus, corn and strawberries. Spread fresh and lightly, and compost with dry earth. Some recommend lime and wood ashes with poultry droppings. But these chemicals at once begin to liberate the ammonia in the manure and the nitrogen in the poultry droppings is then largely lost. Use land plaster or road dust and cultivate immediately and you will get the full benefit of all the nitrogen.

As to the number of hens to be kept for profit; that will depend altogether upon the conditions of the farm life. It is better to begin with not more than from twelve to 25 or 40. From 200 to 300 are necessary for a commercial result, and many commercial yards have from 1,500 to 2,000 fowls. A house for 25 hens should be at least

12x18 feet. The 25 will lay far more eggs than 50 hens would in the same space, for hens need a great deal of exercise not only for egg-laying, but to keep them from feather pulling. This size of henhouse will mean about eight square feet to each fowl, and this amount should be enough for even the active egg-laying breeds. It is estimated that every fowl should also be given from ten to twelve cubic feet of air space per pound of live weight, and this amount will be more than secured by such a house if perfectly ventilated. Building a house of this dimension on the south side of a gentle slope, where the soil is dry and porous, and the drainage is perfect, you will be pretty certain to keep your fowls healthy. Such a house can be easily supplemented as to size when building, if more hens are intended to be kept later on.

Building the Poultry House.

There are various ways of building henhouses, but the chief purpose of a henhouse is to keep the hens warm in cold weather. Hardly any reasonable expense is too much for this purpose, because to attempt to save here is like the old saw, "Save at the spigot and spend at the bunghole." Thousands of bushels of grain are thrown away by being fed to hens in cold henhouses. There are no eggs laid in a cold house, and no eggs for four months of the year mean a dead loss to the poultry raiser. Keep your fowls lively, comfortable and contented in cold weather and you will have solved the question of winter eggs for the market.

In order to do this the house for hens should be kept at an even temperature. The even warmth of temperature is absolutely necessary, though some people expect hens to lay in an icehouse. We put storm windows and storm doors on our own houses for winter, but refuse to put out a cent on the henhouse. I have seen plenty of henhouses with a heavy coat of frost lining the walls inside and out and overhead, and yet the farmer grumbled because there was so little market profit in hen-keeping.

A henhouse should be built for a stove, in case of need, with a chimney built through the roof, high enough for a good draft, and also to create a good ventilation. Enclose the stove with a woven wire cage 7 to 8 feet from the stove. Fowls are less inclined to jump a wire than a board fence. A barbed wire at top is also deterrent. Leghorns will jump 7 or 8 feet, so that your fence must be high enough for that breed, if you keep it. Other fowls will only need about 3½ or 4 feet. Coarse chunks of wood make the best fuel, as these furnish charcoal for the hens, and this is a very necessary thing for laying hens in winter.

Care of the Interior.

Everything in the interior of the poultry house must be so arranged that it can be easily cleaned and be readily accessible.

The roosting department for the hens is an enclosure placed in the center at least eighteen inches from the outside wall of the henhouse and two feet from the ground floor. The perches for the hens to roost on should be well seasoned, basswood or pine, peeled poles

two to three inches in diameter and placed on frames about 14 inches apart and 14 inches from the dropping board. Don't fasten the roosts tightly, as they must be taken out often and sunned, as well as cleaned. Be sure to have the perches level, as then the fighting for positions is done away with. A hen goes to roost about four o'clock and sits until about eight the next morning. She is about 16 hours on the roost, and may be exposed to forty degrees change of temperature in that time. Laying departments are drawers right under the roosting department.

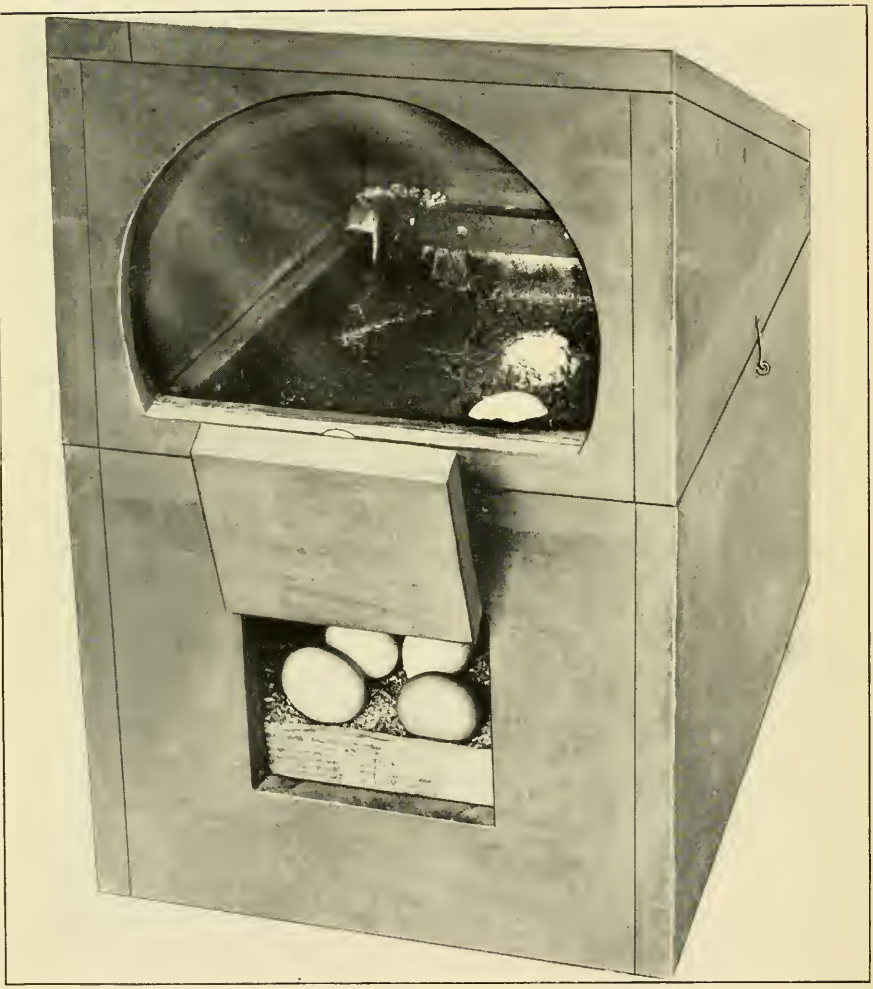
Each poultry house should be provided with dust boxes, placed in full sunlight, from two to three feet long and the same in width, and about six inches deep. These boxes should be kept at least three-fourths full of dry, clean, light dust or dry wood ashes for the hens to burrow in. The boxes should be emptied every two weeks, at least, and refilled with fresh dust. During the winter season, wood ashes are good for the hens to burrow in, especially where they are kept in during rainy and stormy weather. If kept dry, air-slacked lime may be used.

Fresh, clean water should be kept in every poultry house, where the hens can help themselves. Earthern vessels are the best for this. Fresh, warm water is needed every day in winter, and cold water every day in summer. The vessel containing the water should be scalded out with boiling water each time, before fresh water is put in again. There should be a small box or trough in the poultry house, with charcoal broken up for the hens to eat at their leisure.

To prevent loss from lice, let the dust in the boxes be sprinkled with any good insect powder until the dust is slightly tinted with the powder. Do this each time the boxes are emptied.

Everything about the henhouse must be kept free from dirt and moisture. Give plenty of light and ventilation, sunlight especially being needed. Whitewashed walls and clean windows are essentials. Keep about six inches of sand and gravel on the floor and a bed of dry straw chaff frequently renewed. If this litter becomes at all damp it should be removed and new straw or dry leaves supplied. During the winter once a month is not too often for this. The roosts should be cleaned twice a week. Sift air-slacked lime on the dropping places every time after cleaning and rub the roosts with kerosene oil. Fifteen minutes given every morning to a thorough cleaning of the henhouse will be pretty sure to give success to your campaign for a full egg basket.

As May is the month for the worst trouble with lice, April is the time to fumigate the henhouse thoroughly. This is best done by placing a small quantity of burning charcoal in an iron vessel. Close the henhouse tight and burn a lb. of sulphur in each pan. There should be several of these for a large henhouse and the henhouse closed tightly for from 2 to 4 hours. Repeat this regularly during the summer season. By beginning early in the spring the young broods are more likely to be saved from the dangers of lice. If the setting hens are allowed to hatch out and the chickens raised by a brooder, the chicks ought to be clean from lice. But be sure not to fasten your



The safety pocket hen's nest, a protection against all egg-destroying animals.

henhouse fixtures, as said before, as you can clean everything much better by being able to remove them occasionally. Camphorated oil is good for head lice.

Poultry Houses.

Poultry houses can be made in almost any shape, yet for warmth and convenience the octagon or the round silo shape seems to me to be the best. To build an octagon poultry house, have the ground raised, or have the house placed upon high ground so that the house shall be kept perfectly dry at all times. To accommodate 100 hens make the poultry house 80 feet in circumference, that is 10 feet on each side of the octagon, with sills 2x4x10 feet long and 6 foot studs to plate of the same size and length of the sill. On the outside, ceil with matched rough boards, cover with building or tar paper, and then cover with drop siding. All this material should be of best quality and should be painted early for preservation. The diameter of such a building would be about 26 feet, and the rafters about 2x4x14 feet long, according to the pitch desired. These rafters are covered with rough boards and on these the best 3-ply rubberoid or any other good roofing material. Seal with matched, dry lumber the inside of all the outside walls, including the roof, for warmth and as a protection against vermin, and put a good sized paneled door on the side most convenient for your use, with a storm door for winter. Place double windows, each provided with double sash, about 28x36 inches, on the east and south sides of the poultry house, at an angle of about 45 degrees, slanting in at the top, and also provided with storm windows for winter.

About one-half of the distance from the base to center should be made another room, octagon in shape, with sills and studs for braces to the long rafters. These sides should be boarded up with matched boards to the height of about 3 feet, with doors on each side of the octagon. Above the boarded sides common white muslin may be used. Put a partition made of matched lumber through the center of this inner octagon, thus separating the place for nests from the place for roosts. One section can conveniently be made for feed and this can be protected from the hens with a wire screen. A good sized brick chimney should be placed on one side of this inner octagon and extended upward through the roof a little higher than the highest point of the building. This chimney should be provided with a fireplace and protected with a wire screen. This will serve for a ventilator and also for stove pipes, etc., if you should desire to cook poultry food by means of stoves. Warm, well ventilated buildings save about fifty per cent in food stuff.

Another Way to Build the Hen House.

Floor Plan. Lay out wall polygon with 8 (eight) corners, each side being eight feet long. Make cement floor four inches from bottom of sill, then fill in with dirt to bottom of sill. The purpose of this is to make the house rat proof and at the same time warm and dry. The sills should be usually 4x6, studs 2x4, seven feet long, placed

two feet apart. For plate use 2x4 doubled. Tie the building together with 2x4, two feet apart, supported in the center by a 2x8.

The upper floor should not be tight. This will allow the moisture to escape into the chamber. This floor ought to be covered with straw about two feet thick.

The roof is made eight-cornered, the same as the building, with eight main rafters 12 feet long, and a 4x4 between the rafters at the top. Make the ventilator same as the roof. It should be about two feet in diameter. Then cut eight rafters to go between the main rafters and join at the top with the frame of the ventilator. Cut 16 rafters about four feet long to go between the other rafters. This will make a rafter every two feet all around the roof. The ventilator should be slatted so as to let out air and yet not let in rain.

Windows should be placed on the southeast, south and southwest. Set them 6 to 8 inches from the floor. Use windows about 4 feet 10 inches in length and any width desired. Put them on a slant by setting the top in. Make the frames 12 inches deep at top and 4 at the bottom. This will give the window a slant of 8 inches, and will allow the sun to shine on the floor and also make the house warmer. For winter put on storm windows the same slant as inside windows.

Put the door in the east or west side, as desired. Make it 6x2-6. The inside plan consists of two parts; the roosting place, and the nursery. Three feet from each corner draw a circle. Put up studs on this circle two feet apart, reaching to the upper floor, which is 7 feet. Cover this frame with cloth, either ducking or burlap. This will prevent a draft and yet make a comfortable place, and pure air is very important if you can get it without fowls taking cold. This can be done in this way. Put a partition through this circle, dividing it so as to give 7 feet for nursery and 5 for roosting. Make a table two feet high and as wide as the room, leaving a place in front to walk. Then make a frame with legs eighteen inches long for the roosts to rest on. Make the roosts the shape of the building. Underneath the roosts and on the front side make a trough the full length. Then fasten this cloth just underneath the roosts at the back side, and let it slope to the edge of trough and fasten firmly. The dropping from hens will fall on the cloth and pass to the trough, where they can be easily removed.

Nursery. Make nests in the circular side of room by rows, if desired. The nests are to be twelve inches wide and fourteen inches long. See floor plan. Make a door at each end of the nest so that you can shut the nest up, if desired. This arrangement will be found very convenient at times of setting. The doors at the inside of these rooms will be seen in the floor plan. Put a two by ten at the top of the partition to support the roof. In constructing this building look carefully at the cuts, and anyone who is handy with tools can make it. Some deviations might be resorted to, but on the whole it is better to follow plan as indicated.

Chicken House Number 3.

Make this house a square of 24 feet. Build it on level, dry ground, with good stone or brick sills, the walls 2 feet in the ground, 1 foot

above ground. The studding is of 2x4, and covered with heavy building paper on the outside. Over this put a layer of ordinary well seasoned boards, then a second layer of siding. Fill in with sawdust, packed down tight, and line with good straight edged boards. Board in the rafters on the inside, and fill in with dry sawdust before shingling.

Put the roosting place in the east side and the laying department in the center. This laying section should be about 10 feet long, with an alley three feet wide running its length. The nest boxes will be built on three sides. The south side will be all glass from the sill to the plate, with a one-foot slant inward. Six or seven feet of height under the eaves is sufficient. If you build with a hipped roof four or five feet at the eaves is enough. In that case run the glass windows up to the purline plate, putting them in separate sections, from the outside plate to the purline plate. The 1-foot slant will then only be from the sill to the outside plate. For very cold climates add storm windows for winter. The laying department being inclosed in the center, will be warm in winter. Arrange the laying section so that the hens can go into it by going into the alley or on the side.

Chicken House No. 4.

For the west or northwest build this henhouse into a mound, if possible, facing the south or southeast. Into this dig down 3 ft., and back 16 ft., leaving it open to the south. Dig the enclosure 20 ft. long. If you put in a stone foundation for the excavation let it be dug straight down. But if the earth sides are left, slant the ground slightly to avoid caving in. Studding for this should be 2x4, sheathed up with building paper on the inside and ceiled on the outside with good lumber. Fill in with shavings or good sawdust. The house should be built 4 feet high in the eaves, which will make the total height seven feet, with a frontage of 20 feet. The south front should have glass windows with slats across on the inside to prevent the chickens from breaking the glass. In the fall bank up to the eaves with straw on the sides and bank the glass three feet high unless storm windows are put on. This last is the better way, as plenty of sunlight is a great stimulant to egg-laying. In the winter, paper and ceil to the top of the rafters.

Chicken House No. 5.

Directions for cement or square timbered winter henhouse—round or eight-square, with hipped roof. Lay the foundation two feet deep in the ground and one foot wide until above ground. Above ground the wall should be 8 in. wide to the plate. The floor should be of cement below and boards above with an air chamber of two inches between the two floors. The board floor should be of one-inch well seasoned lumber. The walls should be seven feet high from the foundation to the plate. Make the outside wall of cement, studded with one by two inch timbers, and lathed and plastered, the plates two by eight inches, and the rafters two by four inches. A ventilator three or four inches square should be placed in the center of the roof,

with a slide at the bottom of the ventilator so that it can be closed in cold weather.

This henhouse can also be built of either four or six inch square timbers, laid one upon the other, like a wall, from the foundation to the plate. This timbered henhouse should also be lathed and plastered, and the outside covered with good matched siding and painted. Put the roosting department within eighteen inches of the floor and drop a blanket around the roosts after the hens have settled for the night.

Another Plan No. 6.

Another plan for a henhouse divided into two parts, one for roosting and one for a scratching pen, can be followed as below:

1. Make the house twelve feet wide, running north and south twenty-four feet, with no windows on the west side, but have that side and the north end absolutely straight. Partition across ten feet from the north end for roosting pen.
2. Have both windows in the east side, one in the roosting room and one in the scratching room.
3. Place the perches along the west side of the roosting room so they will be as far away from the window as possible.
4. See that the roof is low, especially on the west side—no more than four and one-half feet from the floor, and no more than two and one-half feet above the perches, so as to save all the animal heat at night.
5. Use 4-foot posts on the back side and 6-foot on the front, with a 6-inch space between walls enclosing the entire building. Pack this space with fine hay or flax straw to make the house dry, as well as warm. Use stone or brick for a foundation and have a cement floor regardless of cost.

A St. Paul Chicken House No. 7.

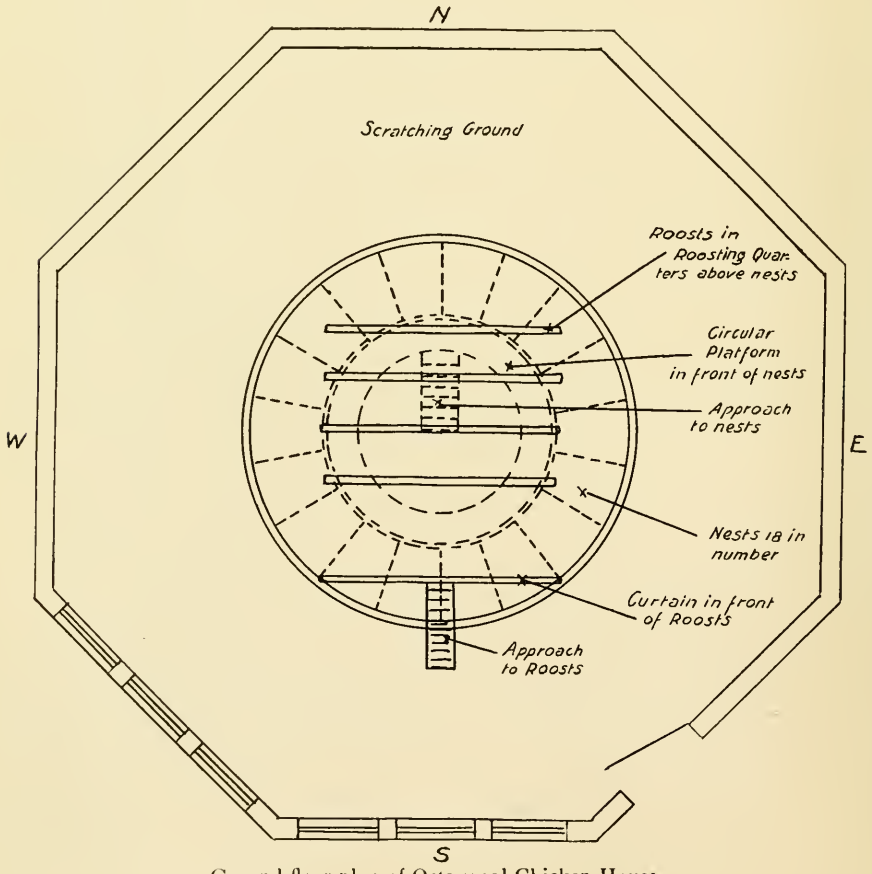
One poultryman of St. Paul, Minn., reports that his 25 incubator-raised hens are kept in a house 20 feet by 6 feet and 10 feet high. Two feet from the ceiling are steam pipes that run from a near building. These are covered with asbestos and on these, which are just warm, the chickens roost at night. Yet this poultryman got, some midwinter days, only one egg, and some days none. Evidently heat was not the greatest thing in the world for those hens so far as winter laying goes.

Did these hens scratch enough for their living and would it not have been better to give them their warm mash in the afternoon, and season it with some stimulant such as cayenne?

The Crookston, Minn., Plan No. 8

A recent bulletin on poultry raising, sent out from the Crookston, Minnesota, Experiment Station, where fowls must be housed five months of the year, recommends a poultry house with lap siding, two thicknesses tarred paper, matched flooring, an air space between studdings, filled with planer shavings or flax straw, and cheap boarding in inside, being three thicknesses of lumber and two of paper, besides air chamber. A loft overhead, filled with straw, renewed every year, makes a dry house.

Perspective, south exposure of Octagonal Chicken House.



Ground floor plan of Octagonal Chicken House.

House No. 9.

All of the above plans are undoubtedly good for mild climates, but for the severe changes of the north and northwest special care in arrangement and construction is necessary. The writer, using the following system during one of the severest seasons of the northwest—that of 1911-12—procured, without artificial heat, 18 eggs from 28 hens per day all winter, while his neighbors did not get any at all. One man in particular put up a modern house at the cost of $700 and did not get any eggs for 3½ months.

The first thing I considered in building from the following plan was location. This should insure perfect drainage, protection from north winds, and a southeast or southwest slope. The next aim was a thoroughly warm house, built with the idea of conserving heat and turning frost from every part of the building. Artificial heat does not always give the best results, but the method that follows I believe will insure plenty of eggs in zero weather for the winter poultry house.

In putting in the foundation for the building it is essential that it be laid below the frost line, probably about 3 feet. This not only turns the frost, but it keeps rats and weazels from getting into the house. Poured concrete is good for the foundation, but should not be run above the level of the floor, as in my experience in cold climates concrete is no good for any kind of farm stock, for the reason that it is too damp, cold and frosty. The best floor for the building is earth, packed solid and raised several inches above the highest surrounding soil. As the sun is the best disinfectant the windows of the house should be so arranged that it will shine in on all of the floor space during the day. For this reason the windows should be placed on the south side and should occupy almost the entire side, extending from about 18 inches from the floor to within the same distance from the rafter plate.

Upon the foundation sills 6x6 or 3-2x6 pieces are used. For the purline plates that the rafters sit on 2x6's may be used. The height of the framework is 6 feet from the top of the foundation to the top of the rafter plate. It is well to put a double thickness of matched plank on the outside of the framework, between which is placed some paper or roofing. Tarred felt, in my experience, is not good because it does not last and during hot weather makes a bad odor. Rubberoid or similar material is good. The inside plank should be run up and down from plate to sill or run diagonally. Thoroughly seasoned lumber should be used. In finishing off the inside, tack on the framework a thickness of rubberoid and then over this a layer of well matched siding. This may be painted or whitewashed. This arrangement gives an air space all around. A good roof is the hip roof, but a simpler and cheaper one is the ordinary lean-to roof.

One of the most essential points is to keep the temperature as even as possible day and night, between 60 and 70 degrees. For this purpose it will be necessary to contrive some simple arrangement that will substitute during the night, the heat that exercise and sun provided during the day. To allow the fowls to roost in the same

pen they have been exercising in during the day without extra covering is not wise—it is not the cold days, but the cold nights, that keeps the hens from laying. To this end I have contrived and used the interior roosting quarters with good success. This is simply a room placed in the center of the house running from the floor to the ceiling, three sides of which are of matched boards and the fourth side open. It does not need to be very large, its size depending upon the number of chickens kept in the house. The best practice calls for from 20 to 30 hens in one house. The open side faces the windows, so that the sun reaches every niche and corner—from the top of this is hung a curtain which is lowered at night as soon as all the birds have gone to roost. This arrangement combines sanitary conditions with warmth and comfort. It provides a double air space and prevents any drafts from striking the birds. Also the body heat is retained and the curtain acts as an equalizer of temperature without creating any drafts. The roosting poles should be placed about 30 inches from the floor. This apartment must be cleaned not less than once a week and the poles rubbed with kerosene oil. A sprinkling of air-slaked lime in this apartment is an excellent help toward cleanliness. It also helps to absorb any moisture which may form. In the morning, between 8 and 9 o'clock, the curtain can be drawn and the chickens allowed to go out into the feeding department. The first feed should be a hot mash, composed of two parts ground corn, one part ground oats, one-half part of wheat bran stirred up in boiling water. The next feed is wheat and oats mixed together and placed on the scratching floor in straw or hay. At mid-day a cabbage hung up by a cord for them to pick at or clover hay or sprouted oats—something green is very important. At about 3 o'clock in the afternoon hot cracked corn and oats is fed. Have always available for their use sand or grit, and oyster shell and charcoal.

Room and cleanliness are very essential things to be observed if maximum egg production is sought. Each hen should have from 6 to 8 square feet of space to do her best. This with light, sunshine and air without drafts will accomplish wonders. Vermin in chickens is the cause of greater mortality than all other agencies combined; to prevent this the house should be fumigated about three times a year; once in the spring as soon as the weather is warm, then during the latter part of June, and then toward the middle of September. The roosts and drop boards should be movable so they can be taken out and cleaned every day and then dusted with lime or hard plaster, known as gypsum. It is a good plan to whitewash twice a year. The kind of dust to use varies with conditions. If the hens are kept indoors, dry wood ashes are good. Road dust, however, is the safest insect powder known and should be used where practicable. The boxes ought to be emptied once a week.

Ventilation.

For all henhouses provide some kind of ventilation. Remember that a cold, dry house is better than a warm, damp one. If a trace of foul odor can be detected on entering the henhouse or any moisture,

open doors and windows at once, at least a little, being careful to avoid drafts. Cloth curtains and muslin fronts are quite satisfactory as means to provide fresh air without drafts. Remember also that it is not so necessary to house your flock very warmly during the day, if the hens are kept out of dampness and out of drafts, but the night quarters must be warm. Dropping the curtain in front of the roosts every night will give the extra warmth needed then, but only proper construction will keep a henhouse dry. A good device for helping out the ventilation of a poultry house consists of a door frame in which two crosswise panels of oiled muslin are inserted, one near the top of the door and the other, a little wider, at the bottom. Between these two panels is a cased and hinged window, protected by a wire screen. The window can be opened as much or as little as desired.

The following ventilator is simple and readily applied to houses already up, which need better air. A shaft is made by nailing together four boards, each a foot wide. This shaft is run straight through the top of the house, and up a couple of feet. A cap keeps out the snow. Some rest the cap on four little pillars. Others have a cap running to a point and starting from two sides of shaft, the other two sides being left open. This shaft should come down to within six or eight inches of the floor and, of course, be open at the bottom. Care must be taken that the roof is properly tinned around the ventilator where the latter passes through, so there will be no leaking of the roof. This central ventilator is more in the way than those built in wall, but actually draws better, as I know by experience of both. A built-in shaft should be in a south wall or in a partition, to avoid chill.

The Scratching Room.

A light and sunny scratching room for fowls is a requisite for the cold climate, with at least a foot of straw on the floor. But even when the weather is very cold the fowls can be let out in a scratching yard protected by a hedge or even by any makeshift for a fence and covering, such as old boards and farm yard litter of straw or cornstalks. Get the fowls out some way, at least for a short time each day, and take that time to clean up the henhouse. But do not turn them out on cold snow, but on litter. If one has the space to give, catch crops sown in the poultry yards and scratching sheds prove of benefit in the matter of green food. Rye sown in the fall will give plenty of accessible green food in the early summer. It is best, if possible, however, not to keep poultry on the same ground year after year, to which I may add that after a hen is two years old her room is better than her company on any real poultry farm.

A California poultry breeder recommends dry leaves for litter in a scratching yard, as they are too light to pack easily. In that locality, especially southern California, where other litter is not always available, spading or plowing up the yards is a method used as a medium for raking grain foods into the soil. By this plan the soil has to be frequently worked over. If leaves or straw be used, eight or ten inches of depth is not too much of an application. The hens get vigorous exercise in such litter.

Have your scratching yard as large as possible for the farm hen that runs at large is well known to lay the most eggs, as a general rule.

A Cloth Pocket Hen's Nest.

This form of nest is good for hens that eat their own eggs. Take a piece of burlap, or any strong cloth or cloth wire and tack it on the inside of the box for the hen so that the bottom will be six inches deep. Add to this, before it is tacked to the nest, a pocket in the shape of a trough, along which the eggs will roll to one side of the box. Keep straw in the bottom of the box, upon which the eggs will slide out from the pocket. Hang this pocket with a good slant and make the hole at the end through which the egg passes abundantly large. Shape the nest itself like a water bowl. This nest arrangement will also prevent animals from stealing the eggs.

One woman poultry raiser says she has found small wooden boxes, procured from the grocery stores and nailed up in the nesting department, more convenient than regularly built nests. They are easily taken down for cleaning and when hens get broody they can be given eggs in these boxes to which they are wonted, and covered with a board or a hinged cover, thus insuring seclusion and a tranquil mind to biddy. Such movable nests are also useful for breaking up the sitting desire at the wrong time.

All nests should be simply constructed and easily moved and cleaned, and, if possible, put in a dark place to prevent egg eating. If placed under the dropping board, with a hinge door in front to lift up when securing eggs, and an alley in the rear where biddy can sneak in to lay her egg, the arrangement is ideal if it can be kept free from lice. A careful painstaking poultryman may keep it so, but as a rule being so near the roosting quarters and being dark makes it a favorite place for the accumulation of mites. Nests that can be carried outdoors, whitewashed, sprayed and aired at intervals are preferable for busy people. The wire nests sold to hang on the wall are not liked by hens, as they lack stability; for biddy has her own ideas about nests and will generally desert the finest nests that can be built and lay her eggs in a barrel if she can find one. In fact, several hens will sit around and wait for the barrel when half the nests are empty.

Boxes, therefore, set on platforms, or hooked to walls, may be considered most suited to the hen's tastes. Make the edges of the boxes high enough so the eggs will not roll out and get broken. Of course, the platform boxes, not coming in contact with the walls are not so likely to harbor mites. Cheese boxes make good nests, as they have no corners. For square nests those about eleven by fourteen inches, inside measurement, are large enough for Wyandottes or Plymouth Rocks. Other breeds in proportion. Don't make the boxes so deep that the hen will jump down on the eggs and break them. Have covers, open daytimes and closed nights. Secondhand boxes from the stores are satisfactory. Keep your nests separate by all means.

Let hens set outdoors during the spring and summer season. A very common way is to furnish biddy a barrel laid on its side in a

secluded place and ballasted so that it will not roll. This makes a good place for either hens or turkeys to lay or set in. Make the nest perfectly fresh every time, and it is a good plan to whitewash the barrel inside and out. Put about 4 inches of fresh earth in the barrel and on top of this make the nest of straw or other material. At night place a board in front of the nest to keep out rats or other egg thieves.

It is well to sell non-layers in the spring, before chickens fill the market and bring down the price. Eggs, also, are lower in the spring, and the new broods will need the room of the old hens. A good way to tell a non-layer is to see whether the rear bones are wide apart or close together at the points below the tail feathers. If they are close together that biddy is better for market.

Laying and Setting.

Six hundred eggs are said to be due from a small fowl. A hen lays about 200 eggs in the first year of laying. In the next three years she totals about 370. In the last four of her egg-producing years she lays a little over 200 eggs. A hen that will lay 200 eggs a year is scarce; and scarcer than hen's teeth is the fowl that lays an egg a day. But hens do break all records once in a while by the egg a day method, while some breeders report 240 eggs a year.

The average hen should lay 150 eggs a year. If she does she will have produced two pounds of pure carbonated lime. This shows how much fowls must depend either upon their food or their grit for successful results. But the average hen does not lay 150 eggs a year. Half that number would be nearer a fair estimate.

In choosing hens choose American breeds for their meat, but Asiatics for eggs. Glossy plumaged trim fowls pay best. Breed from tested layers of thoroughbreds. For winter layers set some hens in March and April for next winter layers. Early spring pullets are the best for winter layers. Get the chicks for early layers all hatched by May 15 or before. As one poultry man declares early hatched chickens, kept growing on grass, cottage cheese, wheat, ground bone and pudding, with shorts, bran, bean meal and oil cake to balance the corn meal, get to laying before cold weather and keep right on. Late hatched ones may get size but not maturity. They will not start laying in face of cold weather, hence go over till next spring.

Then set some hens in July and August so as to have late pullets for the next summer. Late hatched pullets are always the best next summer layers. Hens are a good deal like cows in giving milk in some respects. Some hens lay eggs almost the year around, while others only lay a few dozen. The eggs should be saved from the best layers for setting, as the chick from a good laying hen makes the best layer.

Varieties.

The single comb Brown Leghorn, which is a small feeder, laying well in the summer on small rations, is the best for daily profit in eggs. They mature early also, and while not sitters, by using an incubator or Plymouth Rocks it will be possible to hatch winter layers sometimes as early as June or July. In any case, breed only from the

choicest of your flock and improve it each year by new blood. While mongrel stock, under the conditions of big farms, will sometimes bring good results, the best financial returns come from those strictly large commercial plants where pure breeds are maintained. Leghorns, Minorcas and Hamburgs are probably the greatest producers of eggs. Neither of these breeds is adapted to close ranging. Brahmas and Cochins, both fair layers, thrive well in small quarters. The Light Brahmas have many good qualities and, together with the varieties of Wyandottes, are popular. The White, Buff and Silver Duckwing Leghorn are excellent layers the year around. For the large farmer, where hundreds of hens are kept, and their food is raised on the farm, the small breeds of hens are the best.

The Wyandottes have about seven varieties. Of these the Silvers, the Blacks, the Silver Penciled and one strain of the Whites are said, by commercial poultrymen, to develop, both in meat qualities and egg-production, more than a month sooner than will the other strains of the same breed. But most poultry breeders do not advise that too much stress be put upon this matter of getting early eggs. Don't let your pullets lay until they get to be a good size. No matter if they are from February hatches and can go upon the range in May. If they are under-sized, keep them by themselves, and give them a non-stimulating diet and a small range for exercise.

The Orpingtons are fine for market sellers, their meat being unusually delicate. Remember that a very full-feathered breed indicates poorer layers. Rapid feathering, however, shows a quickly maturing and bountiful layer.

Good Winter Layers.

As I have said before, pullets hatched in March make the best winter layers, with yearlings next. Spring hatched pullets should be placed in permanent quarters in October. If you use the colony system do not exceed flocks of two dozen. By the first of November they ought to begin laying if well situated and treated. Be sure they have thoroughly clean quarters, whitewashed entirely, with cut straw in the nests, leaves on the floor and any good disinfectant such as coal ashes, plaster, etc., beneath the perches. Ashes sprinkled in the nests before putting in straw, also two or three moth balls put in, will help to keep away lice. Here let me say that a bucket spray pump is the best thing with which to whitewash the henhouse.

Don't cross breeds, as you get then inferior fowls. Inbreeding always reduces the size of the hen. A good way to improve a flock of hens, so says a practical poultry keeper, "Is to get a pure blood cock, breeding him two years, and then get another of the same breed, but not related in blood. Do this for five or six years and you will have a flock for all practical purposes as good as it would be of pure bred stock."

"Older mothers for quality, but younger ones for quantity." Laying qualities may be transmitted through male birds, and males from the best laying hens can be used for breeders to the great advantage of the flocks. Such pullets, heavily fed, will respond by greater production, but you can't expect that a mother who is a poor layer will

be likely to have any other chicks than of her own sort. In careful breeding lies the great secret of poultrying, and in selecting a male for the next year, pick out the one with a broad deep body and which stands with legs well apart. The breast should be broad, deep and well rounded out so as to present a meaty appearance. Birds of this kind are worth many times the value of the common roosters generally used and if they are purely bred males, will reproduce their meaty flesh in their offspring. The shape and vigor of a breeding male is of much more importance than excessive size. The medium sized bird is nearly always the best breeder. Nor do breeders of poultry pay much heed to the size of the eggs for setting, or incubation. They ask about the strain of good qualities that the egg represents.

Setting Hens.

In buying eggs for hatching, always rest eggs from a distance a few hours before setting. See that the hatching hen is free from parasites, whether scale insects on the legs, body lice or mites. No kerosene or any oil or grease should come in contact with the eggs or be used around the nests. A packing box 15 in. long and wide, and 16 or 18 in. high makes a nice nest. Arrange a sliding or hinged door so that the hen can be confined to the nest at will. The top of the box should be covered with cotton and there should be openings in the back for ventilation. Whatever you make the nest of plan to fit it as nearly as possible to the shape of the hen's body. One poultry breeder I know makes a nest from a piece of dry turf from 12 to 15 in. square, cut thin in the center. Either this or earth makes a good nest, being easy to shape, moist and a non-conductor of heat. Cover the earth with good straw, well broken. Straw cut with a machine is too sharply pointed, while hay gives a lure for mice to hunt for seeds and the hen is likely to scratch for these same seeds and break the eggs. To keep away lice and other vermin, mix tobacco stems well with the straw and dust the whole thoroughly with common, cheap, powdered sulphur from the druggists. The heat from the hen's body causes the sulphur to give off a smell that keeps lice, etc., away off. This method enables one to start several setters to hatching at the same time and in the same pen.

Put the hen in the nest at night, after thoroughly dusting with insect powder or sulphur. Shut her in and do not disturb until the next afternoon. Then put dishes of whole corn, grit and water in the pen, and take out the hen for feeding, leaving her to return to her nest at will. When the nests are examined at night, give to all the hens that seem quiet and contented, from ten to fifteen eggs, according to the size of the hen.

The hens must take a daily run. Feed all at the same time, taking gently from the nests all that do not leave them. They will form the habit in a day or so and come out when the door is opened to eat, drink and have a dust bath. Whole corn is the best food. See that the hen returns to her own nest and examine nests while the hens are feeding to see whether eggs have been broken. If they have, wash the soiled eggs in tepid water, to prevent the clogging of pores of the

shells. Do not handle further, except to test the eggs on the 8th or 9th day of incubation. If very warm and dry during incubation, it is best to moisten the earth around the outside of the nest boxes on the 18th day of incubation. This supplied moisture will further soften the membrane inside the shell of the egg and permit its ready separation by the chick. Dust the hen thoroughly while sitting and never let her attempt to hatch two broods in succession. If a hatch of purchased eggs disappoints, the sender should at once be notified and given the whole history of incubation, so that if the buyer is not at fault the sender will duplicate. As the buyer purchases the eggs in the hope of getting full-blooded stock cheaper than he can by purchasing birds the inference is in his favor that he would use every reasonable care to get the value of his investment. The sender is therefore likely to feel his obligation to duplicate if a satisfactory record is sent him.

Laying hens are great drinkers, therefore give warm water in plenty and keep a few rusty iron nails in the drinking vessels.

Don't give red pepper or other egg forcers to laying hens. It is most likely to irritate the digestive organs and set up inflammation there. Hens with good appetites and full crops are usually good layers and also healthy hens.

Soft food and mashes may be fed occasionally, but do not have the mashes sloppy. The mash should be slightly cooked and steamed and allowed to become almost cold before feeding.

The Incubator Chicken.

If you mean to carry on poultry raising on a large scale, let me advise, however, the use of incubators, brooders and all the modern aids to prolific egg-hatching and fowl growth. Science has got ahead of nature here in the past ten years. A recent visit to the ostrich farm at Coronado, California, showed this very plainly. Get a standard incubator, run it according to directions, and you will get better returns on an investment in the business of poultry production than by any of the natural methods of the average farm, provided you have hundreds of poultry.

Mr. E. G. Wycoff, of New York state, and Mr. Blanchard, late of the same state, have become independently rich from the raising of poultry. Farmers in general should keep at least five or six times as much poultry as they do. Poultry always brings better prices than pork and can be produced as cheaply. Raise more poultry and fewer pigs.

In raising chickens with the incubator you are fortunate if you raise 75 per cent of the chickens hatched. Follow the directions that accompany the machine exactly and don't try any new tricks with it on your own responsibility. Be sure to hang a thermometer in the brooder and keep it at 90 degrees. Don't open the door of the incubator while they are hatching, but leave the chickens in the incubator for at least two days after the first of them hatched. Transfer as rapidly as possible from the incubator to the brooder, and don't feed anything before the end of the third day, and this should be a light meal.

Feed three times the next day, morning, noon and night; but feed lightly. You can increase the number of light feeds to five per day by the beginning of the second week. Then feed all that they will eat up clean. Clean the lamp in the brooder twice a day, and keep it very clean. If you keep brooder in a shed, away from the other fowls, you can keep the chickens warmer, free from lice and get much better and longer service from the brooder.

One word of advice about incubators is much needed. Buy your machine about a month before you want it and run it for a time in an empty state, so that you can become accustomed to the workings. And another word of advice is to allow just about twice as much space for each chicken as the manufacturer allows. Keep your brooder clean between seasons, don't let old hens use it to roost in, and wean your young chickens away from it by substituting some warm box in its place, which they will take to as a home. The best eggs for incubator service are those which are of medium size, pointed, have a smooth and finished shell and are neither from pullets nor very old hens. One successful incubator raiser says she hatched from Asiatics in March, American breeds in April, and Leghorns and Minorcas in May. Try to get heat upon the chickens from above, just as the hen gives it to them. Make the "hover" warm in some way.

In a recent number of a farm journal I found the following suggestion for utilizing an old incubator. "B. R. E." said:

"If you have a hot water incubator that has given out, don't throw it away as useless. Take off the top of it, take out the tank, measure it accurately and send for a new tank. Put that in place, screw on the top and your incubator is as good as new and at about one-fourth the cost of a new one. Now take your old tank, make a box of nice dry, clear lumber, that is long enough to take in the tank and the heater, and quite a bit wider than the tank. Make it about twelve inches high. Make a smaller box, just the size of the tank, with only a bottom and one side and ends, to slide under the tank. Nail a narrow strip the length of the long box, as far from one side as the width of the tank, tack onto this strips of old soft flannel, then cover the entire affair with a cover that can be removed if necessary, and you have a very good brooder for early chicks.

"It can be warmed by the same kind of a lamp that was used to run it as an incubator. If the tank at sides and top be covered with asbestos paper, which can be bought in large sheets and cut to suit, and the heater wrapped in the asbestos it would remove all uneasiness as to fire. If the tank is one of those that has a tube through the center to form a draft for the lamp, the top of the heater may be covered by a close-fitting disc of tin. In the other kind, a bit of tin laid over that portion of the heater on which the regulator damper rests will send the heat into the tank."

The Hen Hatched Chick.

Don't feed hen hatched young chicks for thirty-six hours at least. Steel cut Quaker oats is good for them fed in its raw, dry form. There should be a vessel near by with water, but great care must be exer-

cised not to let them overdrink when feeding them. Other good foods are raw eggs, thickened with bread crumbs, cracked wheat, johnny cake, baked beans, sweet cut bone, bread soaked in milk and then wrung out dry, dry crumbs, curds that are not ropy, lettuce, chopped onions, eggs boiled one-half hour and well minced, mixed millet seed and wheat, and later cracked corn. Dry food is safest. Cooked food makes them grow faster. Milk is the best drink for chicks. They should have plenty of charcoal and sand and grit, and plenty of fine cut lawn grass.

Never feed grass that has soured in piles to the chicks in hot weather—but see that healthy chicks get a little fresh grass every day. Substituting scalded milk for water often corrects loose bowels, but this feeding should not be kept at too long, as it is finally constipating. Warm skim milk is very valuable for young chickens, and for this reason it would pay any small farmer who has 8 or 10 cows to invest in a good separator and keep his skim milk at home for his young stock and poultry. As separators come down in price this practice will become more common on the farm.

A very useful plan for keeping grit in front of chickens, and which can be made easily, is the device of Robert Colombe, of Little Falls, Minnesota. Take a common salt barrel, cut a hole in one side near the bottom of the barrel large enough to insert a cigar box. Put this in half way, and fasten so that it slants a little toward the outside. Fill the barrel with gravel, cover well, and set so that the fowls will get the grit automatically. By this means they will always have their supply at hand until the barrel is empty. And don't forget to keep a box of crushed oyster shells where chickens can help themselves. Country store keepers nearly all keep these on hand.

Coal ashes not too finely sifted make good grit for chickens. Hens will swallow with evident relish jagged cinders the size of a marble.

Broken crockery is also excellent grit. Pounded up fine it is especially relished by young chicks.

A good device for watering very young chickens is a trough that can be used by the hens and chickens alike, without any danger of drowning the chicks in it. Take three boards and nail together to make a trough, putting boards across the end to make it watertight. Bore holes about 1½ in. apart each way in a fourth board that will just float inside the trough. The young chickens will jump on the float and get the water they need, while the old fowls can drink as usual, standing on the ground.

For a drinking vessel for chickens try also this method, the Geo. Howard "fountain":

Invert a deeper tin can into a potted-beef or fish can, or other shallow tin, with diameter an inch or two larger than that of the deeper can. Bore an awl hole into the side of the inverted can, about a quarter of an inch below where the edge of the shallow tin comes. By dipping these together into a pail of water, filling both while under water and inverting the taller can into the other tin, you have a day's supply. The shallow tin will be full as long as water remains in the

other tin. Give cool, not cold water, or warm milk. If chicks wet themselves much, remove the drink between meals.

Be sure to turn over chicken coops after rains.

Late hatched chicks should be wintered alone, as they require good care and warm, clear, well ventilated quarters. The early hatched chicks should begin to lay in October and lay all winter and early spring. They also are generally fat at the age of 10 or 11 months and will bring the top price in the market or, better still, may be sold to those who desire to improve their flock of hens at a good price.

Chickens for broilers should be in the market very early in the spring. Any yellow-legged bird that matures early and is ready for the market in six or eight weeks is all right as to breed. At that age they are small, juicy and plump, and there is a good market demand for them. Don't try to dress them, but give them plenty of room in shipping and they will be in first rate order when they reach their market.

The Feeding of Poultry.

There is no ideal ration for all flocks, and to know the suitable foods essential is one of the most important problems of the poultry raiser. The farmer who can grow all the variety of rations needed for hens upon his own farm, except, perhaps, some of the mineral matter, has not to meet some of the problems of the commercial poultry raiser, and is saved a great deal of the initial expense of starting a paying poultry business.

If the poultry are to do well they must have some green food, grain food, animal food and mineral matter daily. A load of green and grain food daily will not compensate for a lack of animal and mineral matter, neither will a surplus of the latter two make amends for a shortage of the former two. It is the happy combination of these four classes of foods that causes the hens to lay eggs of quality and quantity and to take on wholesome, well-flavored flesh. Nor is the policy of feeding fowls about half what they want to eat so common as it used to be. It pays to feed liberally. The fowl that eats the most, if fed proper rations, is likely to be the most profitable.

But fowls vary in their appetites from day by day, and according to conditions. If you have a wiry, active Leghorn you can feed it to the limit—but big, sluggish fowls of that breed need judgment as to unlimited corn or barley. Hens laying rapidly eat considerable more than those of the same breed and age not laying to any great extent. Pullets in full laying will consume relatively more feed than mature hens in a state of idleness. Fowls of one breed will eat more food than those of another breed.

The question of feeding depends also to some extent upon the weather. To feed as liberally of corn when the weather is warm as when the thermometer is hovering about the zero point is a mistake. Corn is essentially a warmth producer, and should be fed freely only during cold weather. It is a good plan to make the last meal of the day, fed about an hour before twilight, one of whole or cracked corn, for hens should go to roost at night with a full crop, and therefore the afternoon or evening meal should be a substantial one. The earlier

the birds are fed in the morning the better, and this meal should be of mixed grains, scattered in the two-foot litter of the henhouse floor, but varied often as to the mixture.

Too many would-be poultrymen give their fowls the same old ration of one or two dry grains month after month, and are dismayed that their fowls do not produce more. Vary the ration as much as possible. By way of variety, occasionally add another kind of grain, such as millet seed, kaffir corn, buckwheat, sunflower seeds, or beans and peas. Fowls will scratch all day long in the litter after whole grain.

Crop Rotation For Poultry.

Most valuable advice to small farmers was recently given by Miss Ida E. Tilson, a writer in Farm, Stock and Home. How to utilize a few acres in the interests of poultry breeding was her text.

"At the root of poultry success," she named as food essentials, "clover hay cut young and often, a variety of fresh vegetables, sunflower seeds in the head, and wheat and oats in the bundle, for the hens themselves to thresh, with the resulting straw bedding." But as these are not always or often in the market a system of a four-year crop rotation was outlined by Miss Tilson. I give Miss Tilson's chart below, believing it to be a most scientific and practical arrangement for the small farmer to follow. Some movable fence will be needed. Woven wire fastened to sharp stakes and rolled up for removal or storage is used by Miss Tilson:

	Field 1	Field 2	Field 3	Field 4
1st Year	Clover Pasture	Clover Hay	Hoed Crops	Grain
2d Year	Clover Hay	Hoed Crops	Grain Clover	Clover Pasture
3d Year	Hoed Crops	Grain Clover	Clover Pasture	Clover Hay
4th Year	Grain	Pasture	Hay	Hoed Crops

Mr. T. E. Orr, a well known poultry raiser of Minnesota, once prepared for a farm journal the following table. The amounts named are for forty-five hens and are supposed to keep them for one year. The total is 3,600 pounds, which would cost him $36, an average of 80 pounds of food per hen, at a cost of 80 cents each:

300 lbs. corn $1,87
600 lbs. oats 6.00
400 lbs. wheat 4.00
300 lbs. kaffir or sorghum seed 1.87
400 lbs. bran 3.00
400 lbs. clover 3.00
300 lbs. beef scrap, meat meal, or dried blood 8.00
400 lbs. grit 2.00
300 lbs. oyster shell 2.25
200 lbs. cut bone 4.00

It must be remembered, however, that present day prices are considerably higher than these.

The Warm Mash.

There are so many different times advocated for feeding the warm mash to hens that the best advice to give on this point is to experiment with your hens in your own locality and surroundings before deciding what way gives the best results. The modern theory seems to incline toward dry mash feeding, but a hot mash in the middle of the day is generally advised for hens in a cold climate. Dry food in the morning to keep the hens warm, a hot mash at noon feed in a long trough (which should be kept scrupulously clean), and in which the ground bone can be mixed and thus more evenly distributed, and whole grain enough in the litter at night so that "they will go to bed with a full crop."

At the Minnesota Experiment Farm the following mash is recommended for the farmer's hens: Equal parts of finely ground corn, oats, bran or shorts mixed with about 10 per cent of cooked meat, green cut bone or beef scraps. Mix these foods up dry and mix in thoroughly one-third their bulk of steeped clover leaves, or finely cut clover, which has previously been scalded by pouring hot water on it and covering it with a sack. The clover to be steeped about 12 hours before using.

Another mixture, used at the Crookston Poultry Farm, is made of:

200 pounds bran.
100 pounds shorts.
100 pounds ground corn.
100 pounds ground oats.
100 pounds beef scraps.
10 pounds charcoal.

Moisten this mixture with water a little when feeding it, but "don't make it sloppy."

Various Methods of Feeding.

My own methods of feeding poultry, while not varying greatly from the foregoing, have some few changes—enough to make me believe that my readers, like the fowls, knowing that variety is the spice of life, will wish to read them. I should, by the way, put ground feed in hoppers fastened at the side of the wall of the poultry house. If this is not convenient, then use troughs. In summer, it must be remembered, fowls do not need vegetable food if they range at all. But in winter feed three times a day; once, at least, with a warm mash made of wheat bran, ground oats and a little corn meal. The noon feed can be of wheat and oats alone. In the evening add shelled corn, ground bone occasionally, or meat and milk. The noon feed should be mixed with fine straw, leaves or clover chaff. As I have said before, also plenty of cabbage. The best way to feed this is to hang it up by the roots in the henhouse about 5 or 6 inches from the floor.

Remember to feed meat or lard in winter once a day; also ground bone, allowing about one-half ounce to each hen. This bone meal, ground by a bone cutter, is only necessary about twice a week, and

caution must be used that no bowel trouble results. The bone is only a kind of tonic, stimulating the digestive organs of the fowl, as well as furnishing phosphates, nitrogen and lime for the shells of the eggs. A little meat attached to the bone will not hurt, if it is fed the same day it is cut. But tainted meat or bones or boiled or bleached bones should not be fed, as these have lost their feeding value. It should be added, as to the general method of feeding hens, never feed more than will be eaten up clean. Corn is a great help in the diet for hens, because it keeps them warm in cold weather.

These are my special recommendations for a good, ample diet for laying hens in winter, but there are other poultry keepers who give different formulas. One Wisconsin farmer says, "Barley scattered in straw in the morning, at noon a warm mash of bran and meal, at night cracked corn and wheat." Sorghum seed is also good and clover leaves or chaff, boiled potatoes, vegetables of all kinds, raw, skim milk, warm water. He believes that green bone can be kept for some time in winter. Give plenty of charcoal and gravel in place of grit. This farmer sows several rows of lettuce very early in the spring for hen food, also early cabbage and onions, planning to have a succession of green vegetables. He also suggests that where the dwelling house is warmed by a furnace, and the henhouse is not too far away, a hot air pipe be laid from the cellar to the henhouse.

I have often seen the first milking from a new milch cow fed to the hens. This often causes trouble, especially when they have not had any milk for a long time. Yet milk is one of the best egg producers that can be fed to poultry, and they can be given all that they will drink, provided other conditions are all right. Remember that no amount of good feeding will make up for bad quarters. You can't expect a hen to roost on a fence at night, stay out all day in a fall of snow and then lay, no matter how well she is fed. Hens are mortal—and are even more sensitive to climatic changes than human beings are.

Value of Clover and Alfalfa.

Early but well dried clover and clover meal, young grass or alfalfa contain more available mineral matter than grains do. These are all good food for getting winter eggs and cause deeply colored, attractive yolks. Grinding food for poultry is not necessary unless for the purpose of feeding a mixture or variety that cannot be given in any other shape. Remember, on this point, that green feed in winter is chiefly valuable because it makes it easier for the fowls more thoroughly to assimilate all the food elements of the grain given them. Cabbage is not especially nutritious nor egg-producing, but if you feed cabbages to your hens you will find you will only need about half as much grain as you would on an entire grain diet, and your egg-production will be much increased. I have mentioned clover meal, and this is a very good substitute for green foods, which is not used by poultry keepers as much as it should be. It is cheap and easy to store and keeps for a long time—indefinitely. The necessity for green food to fowls is now so well settled that a substitute of this sort should always be at hand to insure the regular ration of grain and green food to biddy.

Alfalfa possesses a great feeding value for poultry, as it shows seventeen and one-half per cent of protein as against thirteen per cent in clover. The third and fourth crops of alfalfa are said to be the best for poultry foods, being less stemmy and somewhat richer in protein.

But comparing clover, as a poultry food, with wheat bran, the former contains one-third more carbohydrate, pound for pound, over one-half as much protein and more mineral matter than the wheat bran. This is a specially good reason why clover or alfalfa hay should be given to fowls. Clover or alfalfa meal, scalded, with the morning meal, adds therefore not only bulk to it, but valuable nutrients in a cheap form. Hay seems to be as good for chickens as for other live stock. Second growth clover is especially good. Get it harvested early.

An economic source of green food, used by a California woman, is corn stalks. Pull the largest stalks, as many as can be held in the hand; take a good sharp butcher knife and after the manner of whetting with a jack knife, slice them thin, not more than half an inch thick. Begin with the roots; they will eat it all. For the young ones slice thinner; chickens of all ages will go for it as they do for fresh meat. Feed in the morning—because then it is fresh and juicy—all they can eat up by noon. It takes but a few minutes to cut enough for fifty fowls. If one had a feed cutter perhaps it would be easier. If space is limited, plant between the rows when the corn is two feet high, but to continue such a tax and also to have the feed tender, the soil must be kept very rich. The fertilizer from the yards will do wonders. Mangels and sugar beets are good green food also.

Selling Poultry at a Loss.

Too much poor poultry is sold at no profit to the producers. Lots of people have an idea that they must sell the stock in the fall or fore part of winter and whether it is in condition or not it is thrown on the market at a time when the best fowls are not selling for very good prices.

A few bushels of grain fed to that class of poultry while it is held back until the glut in the market has passed will make money for the producer.

It should be remembered that prime or finished poultry is a rare thing, and when it does come in the dealers will ask the producer for his terms. Many a dealer in New York has asked the writer what his price was for his fowls—he wanted them for his best customers.

At one time the writer sold 27 turkeys for $97.67 to a hotel and has made many a sale at the same prices.

United States Senator David B. Hill has feasted on these turkeys and many a student at Cornell University has eaten turkeys raised by the writer.

Geese.

Raising geese is profitable both for the feathers and for market. They require but little care and can be raised on corners of a farm that are apt to be worthless for cultivation. Geese are long-lived,

hardy, small feeders, and need much less expensive food than other market birds. In summer they will live entirely upon grass. They keep their laying and hatching qualities through life; 15 to 20 years is not an uncommon age, and sometimes this extends to 40 years. Thus it will be seen that a goose pasture on a farm where there is a stream or unused spring is a good thing.

The Gray Toulouse and the White Embden are the most profitable. The Toulouse, when mature, weighs about 45 to 50 pounds a pair, and averages forty eggs in a season, but is an unreliable setter. The Embden averages about twenty eggs a season. The flesh of both is excellent, and when turkeys bring from 20 to 27 cents a pound, geese and ducks will sell for 15 and 16.

About all the shelter the geese need is a cheap shed, to which they can go to dry off in time of storm. A plain rough board building, 12x14, with a shed roof, water tight and covered with tarred paper, shingles or tin, and a floor raised 12 to 18 inches from the ground to avoid dampness will accommodate nicely a flock of six or eight. The sides can be covered by 12-inch boards, one inch thick, with joints covered by 3x1 inch strips. Geese are used to water on the outside, but they must have a place to "dry out."

Geese for breeding should be bought as early in the fall as possible—not later than October. A colony of a gander and one to three females need in this climate a lot of from 75 to 100 ft. Young ganders should be kept in a yard until mated.

Geese begin to lay early in March. They will lay from 12 to 16 eggs. Then they will set. If the eggs are taken away and hatched under hens the shell is apt to become dry. In this case sprinkle the eggs every few days with water. The goose will then lay another nest of eggs. Goslings grow rapidly. They will live on grass after two weeks. When grass dies out they need a mixture of corn meal, bran and table scraps in the morning, and cracked corn at night. Green foods in the shape of vegetables, clover and cooked vegetables are also recommended for fertile eggs. If a pond of water is not handy, a tub of water set level with the ground may be used.

Nests made of boxes should be provided in January. Put straw in the boxes and lay them in sheltered places. If she gets broody confine her in a dark box or in another yard, with extra gander. The goose covers her eggs with litter after laying, and this should be disturbed as little as possible. Gather the eggs every day in cold weather, putting in a nest egg from time to time to induce her to keep on laying.

Some geese will begin laying early in December, then stop and begin again in February. As soon as the geese quit laying, pluck the old ones every seven or eight weeks until October. They get full feathered again for killing about the first or second week of December. The young ones pluck every seven weeks from the time the feathers are ripe, which is about the 1st of August. As many as 25 goslings can be given to one hen, providing so many hatch out near together. The goslings do not stay long with the hen, but she will roost with them all season.

Ducks.

Ducks are excellent farm scavengers, as they will eat much that can not be used elsewhere. Duck raising on a large scale has been very profitable for a number of years, especially in the vicinity of the large cities. An example of this is in the career of three brothers in Massachusetts, who, twelve years ago, started with ten Pekin ducks and one incubator, and now market each season about 50,000 ducks. These men started with a played-out truck farm without other capital than good judgment and ability to work. This concern breeds only from two-year-old ducks, from 1,000 to 1,500 being kept to produce eggs for the incubators. In the height of the season, which is June, about twenty men are employed. Last year the income from feathers alone, of which two tons were sold, was $1,500. The Pekin duck is a great grower, reaching 4 to 6 pounds weight in 10 or 11 weeks' time, and as a table delicacy is growing constantly in favor.

In keeping ducks many breeders put the duck houses near a stream of water and divide the pens or flock by means of 3-foot fences extending entirely across. As the proper selection of breeding stock decides the commercial success of a plant, it is very important to keep size and quality together. Pekin ducks are the most easily raised. They are large, a pair weighing sometimes 20 lbs., and the flesh is very delicate. The average of egg production is from 100 to 125 eggs per season. They are not frequent setters. The young ducks are hardy and easily raised.

Breeding ducks do best when yarded and properly fed. After the laying season is over they may range.

The New York Experiment Station sent to the Department of Agriculture some time ago the results of some experiments made in order to find the most nutritive food for ducklings. In the first test two lots were fed a ration in which over ninety-eight per cent of the protein was derived from animal sources, the ration being made up of meat meal, animal meal, dried blood, milk albumen, and bone meal with some green alfalfa. The ten younger ducklings (two weeks old at the beginning of the test) were fed for approximately two months. In the first month 3.2 pounds of dry matter were fed, the average gain was 27.9 ounces, making the cost of feed per pound of gain 6 cents. During the second month the ducklings gained 20.3 ounces on 7.5 pounds of dry feed, costing per pound of gain 13.7 cents.

Other experiments were made with a view to studying the relative value of different proportions of animal food. The rations were made up of different proportions of animal meal, grain mixtures, corn meal, wheat middlings, and green alfalfa. For the whole test, which covered ten weeks, the average gain per duckling was 7.17 ounces, the dry matter eaten per pound of gain 3.9 pounds, and the cost of feed per pound of gain 5.4 cents. It was found that, generally speaking, "during the first few weeks, growth was more rapid and equal growth made for less food under a ration in which 60 per cent of the protein was obtained from animal food, than under rations having respectively 20, 40 and 80 per cent of the protein derived from this source." Results, on the whole, favored the use for the first few weeks of the

ration in which 60 per cent of the protein came from animal food, and later foods containing an increasing proportion of grain foods.

John I. Sipp, an eastern agriculturist, declares that the greatest profit in duck raising is secured if the young are sold when nine to ten weeks old. If they have been properly fed they should weigh four pounds at this age. The pin feathers do not begin to grow until after that time, and they are then relatively easy to prepare for market. They should be given no food for eighteen to twenty-four hours before killing, but water ought to be kept before them. In killing a sharp knife is run through the roof of the mouth and then they are hung up by the feet to bleed. The birds should be grasped by the head and feet and dipped in water just below the boiling point. They must be thoroughly dipped, as their feathers are very thick. Wrapping in a blanket and allowed to steam for a few minutes will cause the feathers to loosen more readily. The head must not be dipped, as it discolors the comb and causes the eyes to sink.

After picking, dip the ducks in water near the boiling point for an instant and then place them in ice cold water for twenty minutes. This will cause them to plump. The market demands that the head and upper portion of the neck be left unpicked and the legs and entrails left intact.

Turkeys.

One of the best breeds for profit in turkey raising is the Bronze. Next to this comes the Holland. Get as large hens and males as you can get of either of these breeds in the fall. The choice will be greater then and the price less. Keep them in good quarters through the winter. A shed for turkeys can be made of either wood or straw and should be enclosed on all sides, with an opening in the middle on the south side about eight or ten feet long on the ground, and two or three feet high. Close the opening at night in very cold weather. In mild weather leave it open. Place boxes at one end for sand, grit, charcoal and grain. The roosts at the other end from six to eight feet from the ground.

It is best to mate young hens with old toms, and old hens with young toms. Inbreeding reduces the size and vitality of the turkey greatly and should not be practiced. Either new toms or new hens should be introduced at intervals and only those should be selected which fill requirements in size and vigor. The poults from pullets' eggs are not as strong as those from yearlings or 2-year-old hens. There is a difference of opinion as to the number of hens to put with one tom. Some breeders advocate 5, others say that 12 is the right proportion. Uusually they begin to look about for a nest about two weeks before they lay. In order to prevent them from stealing their nests it is a good idea to have boxes or barrels or any old litter piled up or placed in the corners of fences and buildings early. When they begin to lay, if the weather is damp or cold, gather the eggs at night, putting a couple of hen's eggs in their place. When the weather is warm and she has laid 16 or 18 eggs, put back the eggs and let her sit. A strong hen turkey should lay 3 settings before she is allowed to set. One successful turkey raiser says that the last week the eggs

should be sprinkled with lukewarm water if the weather is hot and dry, unless the mother is sitting on the ground. Don't try to set turkey eggs under common hens unless the hens are free from lice, for the young turkeys will be likely to get lice, which may mean death for them. Lard and a little sulphur mixed together rubbed on the head and neck of young turkeys will kill the lice.

Turkey chicks are very delicate for about six weeks, and should be kept in dry quarters, well sheltered, with, if possible, a wooden floor to the shelter. Feed nothing for the first twenty-four hours after they are hatched, and leave them with the hen for a day and night before putting in a coop, if they are cooped. For the first week feed minced dandelion with hard boiled eggs. The second week begin to add to the boiled eggs, bread crumbs and barley meal, lessening the egg gradually until three weeks have passed. Then this can be omitted and small grains fed in light quantities with boiled potatoes. Raw meat with onion tops chopped in is good once a day.

They should have a plot of fresh grass to pick on and should be supplied with plenty of sharp sand, grit and good charcoal mashed fine. Some feeders place all the feed on sand so they will get grit this way. They ought to be fed often and only a little at a time. It is better to keep them hungry rather than to feed too much. Guard against vermin by dusting setting nests and hens with insect powder. Hog lard placed under the wings of the hens that brood the young will prevent lice from troubling them. Also grease the head and wings of the young poults.

When cooped remove the coop often to fresh ground. Give water and sweet new milk in shallow vessels, so that they can only wet their beaks. Watch the hen turkeys closely when the chicks are feathered enough to run, and see that they do not take the chicks to swampy places. Until the young are eight or ten weeks old keep in a confined place. Great care should be taken to keep the chicks from getting wet, as they are very susceptible to the damp and cold.

About the biggest problem in turkey raising is in the the proper care of the poults. While the older turkeys are very hardy, the chicks are the most delicate of all poultry to care for. They must be watched very carefully until they get their first plumage and "throw the red" or get their combs. To let the young get wet means nearly always death. Lice can also kill them in a very short time.

The following directions for setting turkey eggs were given in "Wallace's Farmer":

If early young turkeys are wanted eggs should be set under chicken hens (making sure that hens have no lice on them), setting two at the same time. Make a portable pen by nailing boards 2 inches wide, 8 and 10 feet long, to corner posts (2x4), four feet high. Surround this pen with netting three feet wide, tacking it to top of boards and extending it to top of posts. Cut hole in bottom of one of the boards and place a box with a good corner on it outside and against the hole for the hen and brood to roost and find shelter in. Put one hen with both broods in this pen and feed with corn bread baked as for the table, and mixed with about the same amount of milk curd. After

the brood has learned to know the cluck of the hen raise the pen so that they can go in and out at will. Move pen frequently into fresh sod and locate it away from the chicken yard, as lice and wet are death to young turkeys. After the middle of June I allow my turkey hens to rear their own broods, allowing them the liberty of the fields and pastures, but feeding them the same as the others until grasshoppers come. Insects make a natural food for young turkeys and when these are plentiful they need nothing else.

Young, tender grass, finely cracked wheat, apples, cabbages and lettuce are all good turkey feed when chopped fine. Corn meal is not good for young turkeys in any quantity, but a little may be mixed with wheat bran or milk curd. Plenty of charcoal should be given, well powdered, and ashes, road dust or air-slacked lime sprinkled in the bottoms of the coops. Never keep food lying by them when they are still small, and do not let them get wet or draggled in dew or rain. Feed only what they will eat up clean. When fattening turkeys feed liberally with grain and corn meal wet with hot water and give them plenty of clean water to drink. Give vegetables two or three times a week, and finely chopped hay. The second cutting of clover is one of the best grasses for them. Corn is also good for fattening. Don't dispose of the old breeders until they are 8 or 10 years old, provided they are good breeders.

An eastern turkey raiser says that the best fattening ration for turkeys and chickens to round them into shape quickly is three feeds a day of all they can eat of cooked potatoes and corn meal, with one feed of whole grain. The grain should be given as the last feed for the day and may consist of whole corn, buckwheat or wheat, or a mixture of the three. One-tenth of all the soft food should be of ground bone, beef scraps or other animal food, while grit and pounded charcoal must be kept before the birds at all times. Steamed clover, chopped cabbage, beets or other green food ought also to be mixed with the mash and all the fresh water the birds can drink must be provided for. The fowls ought to be kept in rather close confinement and upon a sward, if possible. It is surprising how quickly chickens and turkeys fatten on this special ration and those raising their own poultry for Thanksgiving or the holidays will find no better fattening ration. From eighteen to twenty-one days of such feeding will be sufficient to put them in ideal shape for the table.

The turkey is an insect eater and if he is not confined he is worth as much as a hired man to the farmer in grasshopper season. He is an early riser and travels many miles in the course of the season. In this connection other great insect eaters are the quail and the crow; these birds are worth their weight in gold in the United States for this reason.

Squab Raising.

The constant and increasing demand for squabs (young pigeons) indicates that there is a profitable business to be had in the raising of them. They are most called for in the market when game cannot be bought and broiler chicks are not in. Any farmer's wife meditating pigeon raising should get the largest brood birds she can. Carrier

pigeons are rapid growing birds. Give them proper housing and don't let them roost in any old place. Watch them carefully, give them good, clean nests, and keep them protected from rats, cats, and other prowlers. Get your squabs ready early in the spring.

It has been said that a pair of pigeons can be kept for a dollar a year, or less, and that they will produce at least a dozen squabs a year, averaging $4.00 a dozen for the year. Pigeons will keep on breeding regularly for about seven years, and there is a market for squabs the year around. A pigeon house can be built for a few dollars, if you have no shed suitable on your lot or farm. A flying yard covered with mesh poultry netting can be easily made. By saving the largest and best squabs for breeding the increase and upkeep of the flock is insured. As to the real facts between expenses and income consult those who know how and have raised squabs for years.

Two good books for amateurs in pigeon raising are, "Squabs for Profit," by Rice and Cox, price 50 cents, and "Pigeon Keeping for Amateurs," by J. C. Lyell, price 50 cents. But take all squab raising advice with a few grains of salt until you have tried it yourself. Not long ago Mr. Hiram Lycan, a squab raiser of Paris, Ill., wrote a rather gloomy report of his experience in squab raising. It appears that there are two sides to this business.

Diseases of Fowls.

No matter what disease attacks fowls it is a safe rule to isolate the affected ones at once without a moment's delay after discovery. Then clean and disinfect the coops by kerosene sprays, followed by a coating of whitewash with a little carbolic acid. Fuller directions for specific treatment follow:

Lice.

The dust bath may be considered almost a specific against lice. The hens will throw the dust up through their feathers, effectively smothering these vermin, which, having no lungs, must breathe through apertures in their sides.

Favus.

Sometimes chickens are either affected with the disease known as favus, or with the disease known as depluming scabies. Both of these diseases are similar, as is also the disease known as scaly legs. With favus the disease appears first upon the comb and neck as yellowish raised areas of circular or irregular outline. The skin becomes crusted as the disease progresses, and the chickens lose their plumage. The affected birds should be washed with warm water to make the crust removable, after which the parts may be coated with an ointment made of one part benzine, twenty parts soft soap and enough sulphur to make the mixture into a paste.

Depluming Scabies.

Depluming scabies attacks the feathers, causing them to break off near the skin. Unlike favus, this disease begins at the rump and spreads forward to all parts of the body. It is due to the workings of

a mite. The affected parts should be rubbed with carbolized ointment or an ointment made by mixing one dram of balsam of Peru with one ounce of vaseline.

Scurvy Leg.

Similar to these diseases are the scabs and warts on chicken's legs, which come off sometimes and bleed. These are usually due to scurvy leg, a disease caused by a very small insect working among the scales of the shanks and feet.

Wash with warm water and soak and anoint thoroughly with carbolated vaseline. Or you can get one of the commercial liquids sold for this purpose, dilute it to one-fourth, and dip the shanks in this.

Gapes.

Gapes, a disease caused by the Gape Worm, is usually confined to young chicks. The worm is originally a parasite of the earth worm, and may infect the chicks through several sources: infected drinking water, the eating of angle worms, or the picking up of the parasite from ground which is occupied by other infected chicks, who have coughed up the gape worm. The worm, after birth, makes its home in the windpipe and in fatal cases has been allowed to gather and grow in such quantities that the chick chokes to death. The disease first shows in a slight cough; as the worms grow larger the local irritation increases, and the peculiar gaping which gives name to the disease begins. Sneezing, difficulty in swallowing and breathing are other signs. But as these also accompany pneumonia or bronchitis the constant gaping, in chicks, is almost the only sure sign, especially if there is no rise of temperature with it.

In the early stages the preventive treatment of removal to new ground, absolute clealiness of quarters and utensils, and feeding from boards or shallow dishes thoroughly scalded after each feeding will usually cure the chicks if practiced in time. But it will take some period before much improvement is seen. Some good gape cure mixed with the food is also advised. But if the disease is treated as soon as discovered the trouble is usually self-limiting; as the embryo of the worm is hatched out in the ground, and therefore the great need in the poultry yard is to keep the chicks away from infected ground and observe perfect cleanliness and free use of disinfectants.

Roup.

The various vermin and roup remedies should be kept on hand, and at hand, and used freely. Insect powders are a necessity. If your yards are small, and only a few hens are kept, a whisk broom can be used for cleaning yards, houses or drinking vessels or for applying disinfecting preparations. For larger quarters the use of one of the low-priced spray pumps is the better method. A few cents' worth of the poultry germicides now on the market dissolved in a gallon of water and applied often and regularly will keep down vermin and kill disease germs better than any amount of semi-annual cleaning of infested henhouses. These disinfectants will also often prevent disease when sprinkled on roosts and floors, as the fumes, breathed in by the

fowls help to make them immune. A cheap hand sprayer can be bought for from 75 cents to one dollar. One gallon of the cheapest kerosene and one pint of crude carbolic acid, diluted with one and a half gallons of hot soap suds, makes a cheap but effectual mixture for walls and roosts.

If roup, or chicken cholera, once gets among the chickens on a farm, the germs are likely to remain there for months. Sprinkle air-slacked lime all over the poultry yard after you have raked it clean, in order to destroy these. Roup usually develops from a bad cold. A fowl may sneeze, water a little at the eyes and nostrils, and be generally dumpy as the result of a cold. This cold, if taken hold of at once, can be cured by forcing a little one-grain pill made of strychnine, iron and quinine, down the throat of each sick fowl. Give bread crumbs at the same time. If something of this sort is not done at once the cold will become accompanied by rattling in the throat, when it is called bronchitis. If the chickens gasp, it is pneumonia. Diphtheria may follow, and roup also. This last is so difficult of cure and so very contagious that the safest thing to do is to kill the fowl and burn it. Clean the chicken house and disinfect. Fumigation with sulphur, of the roosting place, driving the fowls into the scratching shed or yard, is advised. Quarantine every chicken that shows the first signs of infection and give each individual the following treatment as a wash. This can also be used internally, in teaspoonful doses: 35 grains chlorate of potassium, 2 grains salicylic acid, 1 oz. each of water and of glycerine. Wash the heads of the chickens with this, as the eyes get glued together.

With an atomizer spray a liquid made of 4 tablespoons witch hazel, 2 tablespoons water and 3 drops carbolic acid into nostrils and mouth. One poultry raiser takes the sick chicken by the feet and dips her head for a second into a pail two-thirds full of water, into which one-half cup of kerosene has been poured. Dip the head just under the surface, dry well with warm cloths and put it in a dry, warm place. Ten drops of turpentine to twenty of sweet oil is a good mixture taken internally. Give about ten drops to a chicken. If tumors develop on head and face paint with equal parts of aconite and iodine.

Do not handle infected fowls without protecting the hands, and burn all cloths or articles used in treatment. For the above very complete directions I am indebted to an article on the subject of roup by Mrs. Ida E. Tilson, an authority on poultry raising and a very clever and painstaking one.

Chicken Cholera and Bowel Troubles.

Chicken cholera, of which the first indication is usually a slight, watery diarrhoea, is also accompanied by a lack of life and spirit, and the bird goes moping around half asleep with ruffled feathers. The droppings become bloody as the result of intense inflammation; the comb darkens; frequently it turns black and the decline is rapid—the bird possibly being sick but a few hours—though the length of time varies. It attacks all kinds of domestic fowls and carries with it a

high fever, while birds become exceedingly weak and may topple over at the slightest touch.

This disease is so often brought into a chicken yard by the introduction of new fowls that are infected that the best suggestion of cure is one of prevention. Quarantine new fowls until you are certain they have no disease germs to give to your flock. Among the remedies offered nothing is better than pure drinking water in which some one of the many excellent cholera remedies now on the market has been placed. Give this to the fowls in any amount that they will drink and keep up the most strict attention to cleanliness and disinfection of yards and quarters for some time after the disease seems to have disappeared. Be sure, also, to burn all dead fowls and disinfect and bury the ashes at some distance from the poultry yard.

There are various forms of bowel troubles, of a more or less serious nature, to which young chicks are subject, but all of these, unless brought in from outside quarters, may be traced back either to improper food or drink or too close confinement and lack of ventilation and cleanliness in chicken houses. The same general treatment as for cholera is advised. Be careful to see that if sour food is given it should be sour from lactic acid and not from fermentation. Sour milk is good, but a sour mash is not.

White diarrhoea is supposed to be a germ disease which attacks the caeca or blind intestine. A post mortem examination will always reveal the presence of Coccidium tennelum, a parasite belonging to the Sporozoa of the division Protozoa, the lowest division of animal life. This same germ attacks turkeys, ducks and pigeons. When this disease prevails, it kills from 60 to 75 per cent of all chicks hatched. It is accompanied by a white, pasty, fecal discharge which pastes up the feathers and closes the vent. There is also a disease which is a contraction of the vent which comes with or without White Diarrhoea, and is always fatal.

The cause is the presence of the germ as above. While this disease may readily be transmitted from the droppings of affected fowls, the primary cause must be sought back to the eggs used for hatching. Hatching eggs should always be antiseptically cleaned by wiping in 95 per cent grain alcohol. If an incubator is used (and it allows the best chance for success against the disease) it should be washed with a solution of some good germicide and exposed to the sun. The egg tray should be scalded and washed with the same solution and, if there is burlap in the nursery or elsewhere, it should be renewed. The same precautions should be taken with the brooders. The soil to which the chicks have access should be well disinfected with the solution, dug up often, and exposed to the purifying effect of sun and air.

Round worms and tape worms are not a cause of serious trouble among fowls, unless they are present in large numbers. But as they may take away from the flesh forming powers of the fowls they should be looked for, if symptoms of diarrhoea and wasting away are seen. They sometimes also cause staggering. A little care and the right remedy will generally overcome the trouble quickly.

Mites.

If you want to know whether you have mites wipe your perches early in the morning with a white cloth or pound the roosts a little. Hot water, sprayed into cracks, or kerosene in the joints, are both good mite killers. Be sure that your coops for chicks are thoroughly cleaned, repaired, disinfected and whitewashed before they are put away for the winter. Remember that mites are not lice, but belong to the spider family. Cats, dogs and some birds of the air may carry these pests, and as they multiply rapidly, and may live for a long time without food, the necessity for constant keeping at their hiding places, which are always dark cracks, is evident, unless you want to keep hens in order to support mites.

Apoplexy.

Apoplexy among chickens is quite a common disease. The chicken suddenly drops dead from the perch or it may have a milder attack, resembling vertigo, when the fowl throws its head and body about as if giddy, and falls in a fluttering, kicking collapse on the ground. Either vertigo or apoplexy are generally due to over-feeding, and the best remedy for vertigo is to drop all the fattening portion of the ration, corn especially. Also confine the sick birds for a time. In cases of vertigo, hold the head of the chicken under a stream of cold water, and this will often revive it. Be sure also that the ventilation of the chicken house is good, and don't let the chickens roost high, as they will do invariably if left to themselves, and if there are any perches near the top of the coops. A chicken which is found lying on the floor of the henhouse, but is still alive, may be restored by opening a blood vessel under the wing and letting it bleed profusely. This relieves the pressure on the brain. Keep your fowls well exercised also to avoid these troubles.

Egg-Eating.

Egg-eating among hens is usually due to eggs being accidentally broken. If hens do not get enough protein in their food or are too closely confined they are apt to eat eggs. If the habit spreads to the flock in general, put in very dark nest boxes, entered from the rear, as only an egg-laying hen will be likely to go into these. The cloth pocket hen's nest described in this chapter is an excellent preventive for this habit.

Feather-Eating.

Feather eating is generally found where fowls are kept in too much confinement without variety of food. Turn the chickens out for a time, if possible, to range for themselves. If you can find the ones that do the eating it may be best to kill them, if not too valuable. Paring the beak of the guilty one down to the quick will sometimes help. Feather eating is most common during the moulting season, when the pin feathers are full of oil, and the cause may be that more animal food may be needed. It would be well to try an increase of green cut bone or fresh meat.

Bumble Foot.

The cause of a rooster's not being able to walk may be due to a warty growth in the ball of his feet known as bumble foot. If this is found to be the case remove the growths with a sharp knife and touch the wound thus made with nitrate of silver. The feet should be bathed frequently in warm water and the bird kept isolated on a bed of leaves or straw.

Limberneck.

The disease limberneck is peculiar to warm climates. It is believed always to come from flocks getting access to carrion and eating too many maggots. The latter go down whole and alive, and before they can be digested they have perforated some membranes of throat or craw. Mycosis, or the mould disease, also acquired from carrion, acts somewhat the same only it is a rapidly growing, suffocating fungus, vegetable, not animal. It may be acquired from very mouldy grain. Copperas is as good as any remedy for Limberneck. A little spirits of turpentine in drinking water, one teaspoon to two quarts may be used for two or three days, or each affected bird be given a turpentine capsule, followed soon after by one teaspoon castor oil. Examination and cleansing of premises is best preventive. Do not eat the fowls or allow any to be sold for food until you are sure your flock is rid of the trouble.

Scours.

Too much soft food for hen hatched chicks is said to be a cause of "scours." With brooder chicks the trouble is usually due to too great extremes in temperature. Either of these suggests its own remedy.

Leg Weakness.

Many large, heavy roosters suffer from leg weakness. Their bodies develop faster in weight than their legs do in strength and as a consequence sooner or later the legs give way under the continual strain. Little can be done in such a case excepting to keep the bird quiet and to give him muscle and strength forming foods. He should be kept in a compartment removed from the other birds and given from two to four grains of powdered sulphate of iron daily in his food.

Night Hawks.

One good way of preventing the night prowling enemies of young chickens has been tried successfully by a Pittsfield, Mass., farmer, who carries on a large poultry business, selling over a thousand fowls as market poultry alone. The chicken plot is made into pens 50x100 ft. and around each of these the farmer plows up a furrow. Boards 8 in. wide are strung along the flat side of the furrow. Stakes are driven to come full 3½ ft. above these, and then the furrows are turned back to the boards. One inch wire netting 3 ft. wide is tacked to the boards at the bottom and at the top to these stakes. This gives a sufficient protection

Another way of protection from hawks is to put the chicks' coops in a small grassy yard, enclosed with a tight fence, high enough to

keep them from getting out. Stick this full of brush, leaving just enough space for the caretaker to get through. The chickens, running through this brush, are saved from the danger of a sudden swoop down from above. A third remedy used against hawks is to hang out dozen sheets of bright tin, each sheet about 5x12 inches with a string attached to one end and this in turn tied to a limb of a tree. The string should be about two feet long, allowing the sheet to revolve constantly. It does frighten hawks.

A good way to keep the chicks away from rats is to raise the coops on posts about two feet from the ground with inverted tin pans over these. Runs for the chicks leading up to the coop entrance are dropped at night, and the door closed. At each end of the coop roof are ventilators covered with wire screens.

The best way to break up broody hens is to confine them to a dry smooth floor, without litter, in company with an active cockerel and feed them liberally with stimulating food.

General Helps.

Store plenty of dry earth under cover before winter sets in, so that the hens will not lack for a dust bath in cold weather. You will also need the clean, dry earth on the henhouse floor for a disinfectant and absorbent.

Don't put pine sawdust on poultry floors. It becomes infested with fleas. Cedar sawdust is all right.

There is nothing more valuable for the poultryman or farmer during the winter than a feed cooker or boiler to cook feed, heat water, make spray mixtures and a dozen other things. The morning mash or feed for the stock can be prepared the afternoon before and left to heat up during the night. Warm feeds and water are essential during the cold months.

Plum trees are good in a poultry yard, as the chickens tend to hold in check the curculio, one of the plum tree pests. Wherever other fruit trees will grow they can be planted to good advantage in a poultry yard. Apples, crab apples, pears, peaches or cherries will be benefited by the poultry pickings and will also give the fowls an abundance of shade.

The dropping canvas to hang below the hen roost is much better than the board platform. Hang it on hooks twelve inches below the roost by several small rings sewed to it. Then it can be easily removed, carried out, cleaned and sprinkled with air-slacked lime.

City people can keep a few hens for eggs without males. This not only precludes breeding, but it precludes the crowing of the rooster in the morning. When the hens are beyond the age of profitable egg-producing they can be disposed of for eating purposes and pullets bought from some reliable breeder.

It is often desirable to move hens from their own chosen nests to a place more convenient for their owner. In such cases its hould be done at night, and the new nest should be well filled with eggs. It is also important that it should be dark and so arranged that a cover may be placed over it to shut off the hen's view of the surroundings

until she has become fairly fixed in her new quarters and the old nest forgotten.

An old broom makes a good scrubbing brush for a henhouse.

Do not have too much glass in your henhouse. On the south side is sufficient.

Storing Eggs.

There are several ways to preserve eggs for home use, but the most satisfactory method is to place them in sodium silicate (water-glass). A large jar is secured and thoroughly cleaned. Then to every fifteen quarts of cold boiled water add one quart of water-glass. Into this solution the eggs are placed as they are collected until the jar is filled within three inches of the top. Two inches of the liquid should always overlay the eggs. This method of storage is very cheap, costing but about one cent per dozen. When eggs are stored by any method they should never be washed, for this makes the shells porous and detracts from their keeping qualities. The eggs should be infertile, that is, they should be from hens having no males running with them, for infertile eggs keep better and longer than fertile ones. The shells should be absolutely clean and the eggs absolutely fresh. Eggs with cracked shells ought never to be stored by this or other methods.

Uses of Eggs.

The usefulness of eggs is by no means confined to the food value of the egg, although, compared with other food, eggs still keep their relative economic relation to meat as to their food value, whether in nutritive or financial qualities. But eggs have a decidedly medicinal use, and here are some of them:

A raw egg swallowed at once when a fishbone is caught in the throat beyond the reach of the finger will dislodge the bone and carry it down. The white of a raw egg turned over a burn or scald is most soothing and cooling. It can be applied quickly and will prevent inflammation, beside relieving the stinging pain. A mustard plaster made with the white of an egg will not leave a blister. The white skin that lines the shell of an egg is a useful application for a boil. The white of an egg beaten with loaf sugar and lemon relieves hoarseness—a teaspoonful taken every hour. An egg added to the morning cup of coffee makes a good tonic. A raw egg with the yolk unbroken, taken in a glass of the best sherry wine, is beneficial for convalescents. An excellent remedy for bowel troubles is partly beaten raw egg taken at one swallow. It is healing to the inflamed stomach and intestines, and will relieve the feeling of distress. Four eggs taken in this manner in twenty-four hours will form the best kind of nourishment, as well as medicine.

The white of a raw egg is the most satisfactory of pastes. Papers intended to be put over tumblers of jelly and jam will hold very securely and be air tight if dipped in the white of an egg. A raw egg is one of the most nutritious of foods and may be taken very easily if the yolk is not broken. A little nutmeg grated upon the egg, a few drops of lemon juice added, some chopped parsley sprinkled over it,

or some salt and a dash of cayenne pepper, vary the flavor and tend to make it more palatable. The turning of eggs is said to prevent their getting stale, as when the egg rests in one position too long the yolk works its way through the white to the shell bottom and is affected by the air through the shell.

Summary.

Remember that fowls need certain things for egg production, in perfect shape, for the best commercial results. Granted you have good stock these things are:

1. Warmth.
2. Ventilation.
3. Cleanliness.
4. Plenty of range for exercise.
5. A food ration that will give cereal, animal, vegetable and mineral matter in the right proportions, and in variety, fed regularly.
6. Plenty of fresh water, and of warm skim milk, in clean vessels.
7. Intelligent treatment of the hen's peculiarities and appetite. Never overfeed. Watch the quality of food for young chickens and the amount for old ones, and keep green food and grit before hens all the time.
8. Immediate attention to diseases, although perfect cleanliness will usually prevent diseases.

CHAPTER XVII

Stock Breeding

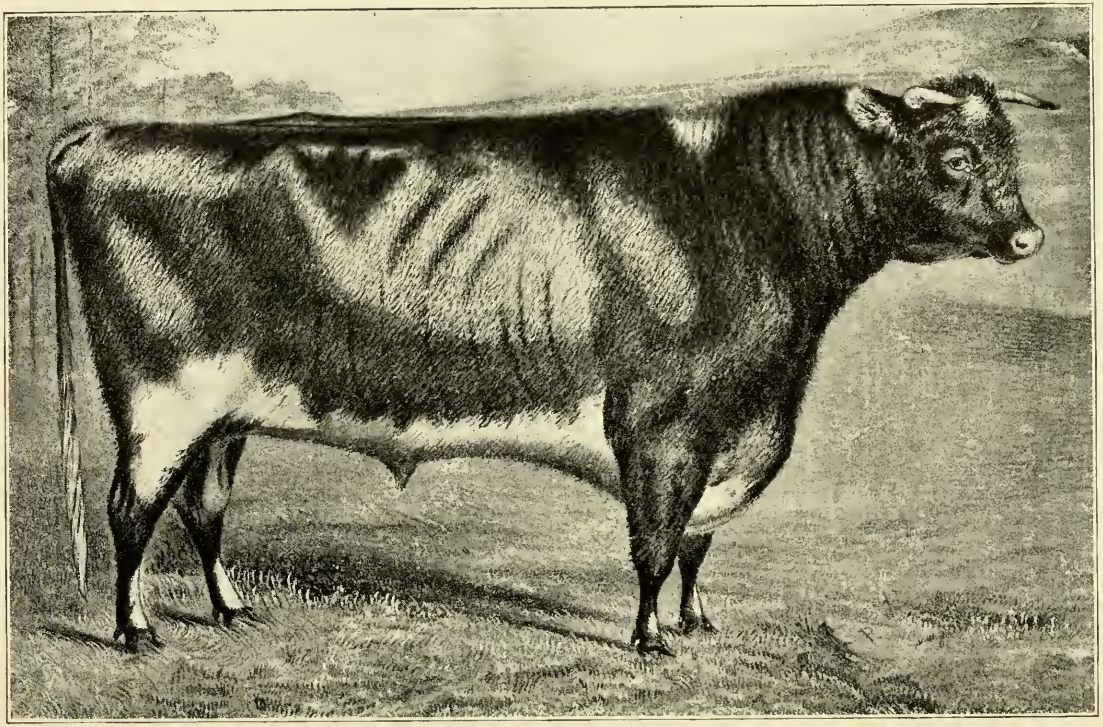
THE breeding of live stock is absolutely necessary to a perfect system of farming. The keeping of a great variety of live stock upon the farm not only furnishes profitable work during the whole year, and adds greatly to the revenues that may be derived from the land, but it also converts the grain and grass of a farm into products which add to the value of these crops, and at the same time make the smallest draft on the farm's plant food resources.

Assuming that we need not argue the advisability of every farmer keeping live stock, the only remaining question to be settled is what class and what breed shall be kept. In the first place, it is my candid belief that too many farmers, and especially stock breeders, in purchasing a sire, buy the pedigree only, and too often pay dear for it, while the individual itself is very deficient in type, outline and many of the essential points necessary to constitute a good sire.

No matter what class of live stock you desire to raise, let it always be pure bred. The time of the "penny royal" steer, "razor-back" hog and "native" sheep is past, not to be thought of in these days, when all agree that the greatest benefit from live stock is only derived when good blood flows through their veins. Yet, if you can not begin with pure bred stock at first, you should strive to improve your stock by always using pure bred sires. By doing this for a few years your herd will become, for all practical purposes, as good as pure bred. Breeders have been so successful in fixing types that pure bred animals can, with almost absolute certainty, be counted on to produce progeny that in every way is true to type, and great marks of improvement have been made on the original stock. This may be counted on as true in all classes of live stock. Let every stock breeder, in the first place, in purchasing a sire, be sure to select a good individual, with well defined outlines and type, and with a general combination of excellent points and pure breed. Then investigate his pedigree, seeing to it that it reaches back through several generations of ancestors of excellent strains.

In case you do not feel like trusting your own judgment alone in selecting a sire, it is not always wise to employ the veterinary who happens to be near at hand, for while most veterinaries are good judges of disease among live stock, in most cases they are very poor judges of good sires, for they have not made any particular study of that subject. Other things being equal, the man, or woman, raised on a stock farm, has, from practical experience in raising stock, the best knowledge, and is therefore the best judge of good sires. As a general rule suit the class of stock to be raised on the farm to some

ORANGE BLOSSOM OF FAIRVIEW 3rd, Shorthorn. Owned by E. Ladd, North Yamhill, Oregon. 1st Prize at St. Louis World's Fair, 1904



DUKE OF AIRDRIE. Bred by R. A. Alexander, Airdrie House, Scotland. exported by him to "Woodburn Farm," Spring Station, Kentucky, September, 1858.

particular purpose, whether the stock to be selected be cows for dairying purposes, horses for speed and durability, sheep to produce large fleeces of wool that find a ready market, or to make good, heavy mutton, or swine that require the least amount of food to produce the largest per cent of profit for the feeder.

Native Cattle.

The introduction of native cattle into the states and territories began as early as 1525.

The Dutch, in New York, imported cattle, commencing in 1625; the English, in Massachusetts, in 1624; and importations by the English to Pennsylvania began in 1662. Our native stock all sprang from these importations. It is impossible to trace any direct pedigree of our native cattle, but some writers trace the origin of our common stock to the English Devon. A number of the early settlers were from the south of England, where the Devon cattle were the prevailing breed, and this was the breed the New England people brought to the eastern states. The predominant color was an all-over dark red and their horns were quite long.

Short Horn Cattle.

This breed of cattle has attained a distinction and won a substantial appreciation which no other has so fully and widely enjoyed among the enlightened grazers of the world. From Great Britain its dissemination has extended to the continent, to Australia, to South Africa, South America, Mexico, and to the West Indies, while it has secured almost a monopoly of the importations of this country and Canada. For the grass pastures of the Ohio valley, and the abundant natural and cultivated grasses of the broader prairies of the Mississippi region, it is admirably fitted and held in high esteem as the most economical machine for the speedy conversion of corn and grass into meat and money.

The original short horn occupied the east of England, Yorkshire, and the valley of the Tee at the date of the earliest records of British stock growing. They were various in size, color and other peculiarities; the dark skinned herds of the fens resembling the black cattle of the Holland marshes, and the finer forms of Yorkshire and Durham assuming the style and quality of the noted cattle of Holstein and Jutland. Yet it may not certainly be known whether the ancient emigrants from those localities brought this stock to England or whether this similarity is the result of climate and keeping. It was at least a race very distinct from that of Ireland and the west of England, with long horns, thick skins, and a heavy coat of hair, well suited for their protection in a climate subject to continuous seasons of rain. It is well known in later times that Dutch and Danish importations modified these cattle of the east of England, and suggested the more recent and greater improvements of Charles and Robert Colling, commencing about the era of our revolution, and continued successfully since by Messrs. Bates, Booth, Townley, and others in England, and Thorne, Alexander, and other breeders in this country.

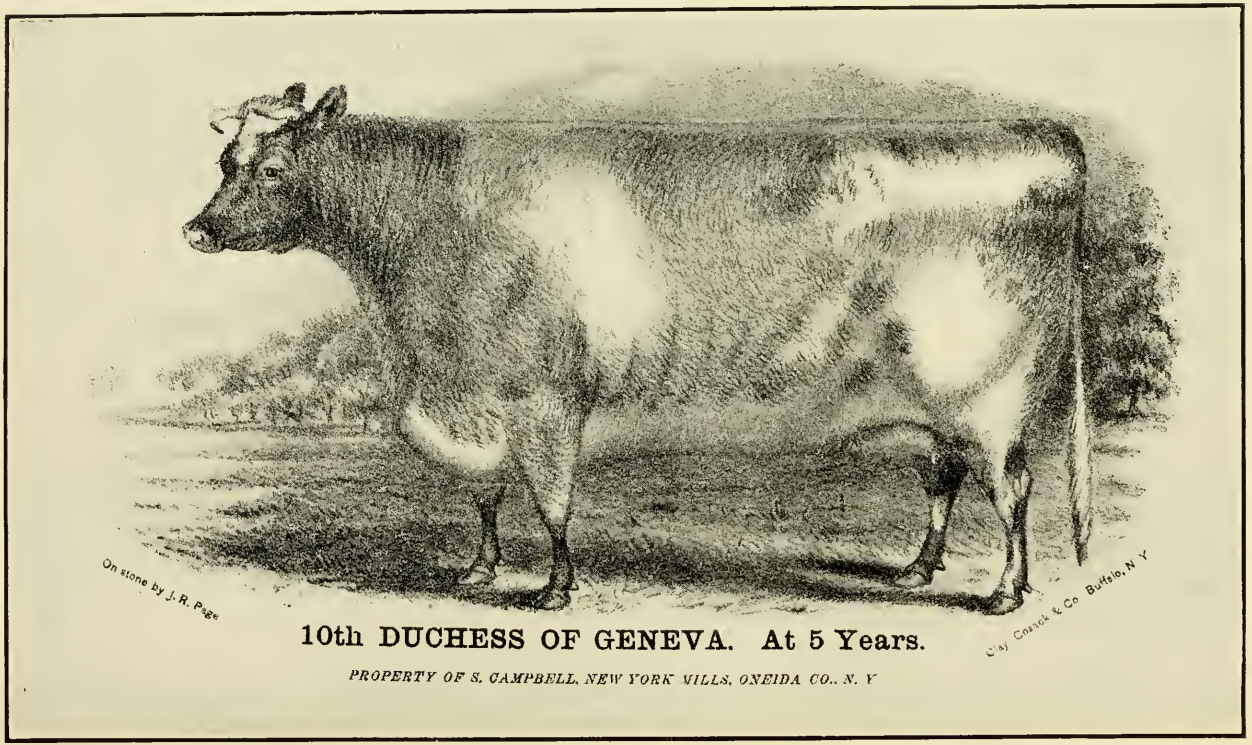
The story of the bull Hubback, the founder of the modern short horn, has often been told. He was purchased in 1783 by Charles Colling of his brother and a Mr. Waistell for eight guineas, and is said to have been from a cow grazed by a poor man on the highway. It has long been a matter of controversy whether he was a pure bred Teeswater,—the short horn of that day. He was somewhat below the usual size of the Teeswaters, yellow, red and white in color, of a fine, compact form, admirable touch, and so easily fattened that he early became useless as a bull. The cow also purchased by Colling acquired fat very rapidly, and never again bred. Either from mere curiosity or from a suspicion that he was impairing the constitution of his animals by continuous breeding in too small a circle, Colling tried the experiment of infusing some of the Galloway blood, which was confined, it is understood, to a single cross upon certain individuals of his herd. At the sale of Charles Colling, in 1810, forty-seven animals produced 8,911 guineas, or about $44,555. Robert Colling, not so renowned, but esteemed by many quite as judicious a breeder, sold sixty-one animals (but six of them bulls) for 7,484 guineas, equal to $37,420. High prices have also been maintained by later breeders. Mr. Bates, in 1850, sold one family of Duchess stock, including calves, at an average of $581. Lord Ducie's herd, in 1853, realized an average of $760 for sixty-two animals. Individuals of superior excellence, from the day when Colling's "Comet" sold for 1,000 guineas, have commanded fabulous prices. Similar prices have been obtained in this country.

There were at least five hundred herds of pure bred short horns in Great Britain ten years ago. From six to seven thousand head were registered in the herd book every alternate year at that period, and these numbers are yearly increasing in accelerated ratio.

Derived from a large breed the improved short horn is heavy, less in weight than the originals of the Tees, rounder and deeper in the trunk, the limbs shorter, chest and back broader, appearing less in bulk, while really greater in weight. The skin is light colored, hair reddish brown or white or mixed, the muzzle flesh colored, the horns shorter and lighter colored than in the former breed, the skin soft to the touch, the form square, the shoulder upright, and the hind quarter large. The color can not be characterized by a single term, varying greatly from a pure white to a rich red, a mixture being the fashion, known as roan or strawberry. The skin should be velvety and not too thin, while the hair should be plentiful and of a mossy softness. The head of the female is finer and more tapering than that of the male, the neck thinner and lighter, and her shoulders inclining to narrow towards the chin. The short horn looks smaller than he is. He excells all other stock in facility of fattening, making good and heavy beef in thirty months, and even in two years.

The idea is somewhat prevalent that short horn cows are not good milkers. It has been obtained, without doubt, from the fact of the well known efforts made to perfect their fattening qualities, in accordance with Bakewell's saying that, "All was useless that was not beef." It is true of many families of short horns. Others are su-

This pair of Holstein oxen weighed 9800 lbs. Owned by Ran & Son, Stetson, Maine.



10th DUCHESS OF GENEVA. At 5 Years.

PROPERTY OF S. CAMPBELL, NEW YORK MILLS, ONEIDA CO., N. Y

This cow was sold at auction for $3,600. She was purchased by an English breeder.

perior milkers. The original Holstein blood of the Durham and Holderness districts was famous for its milking quality, and it is difficult to breed it out with all the culture which the modern improved short horns have received. The modern Holderness stock at this day chiefly supplies the London dairies, and many of their best milkers have strong strains of the improved blood. The Duchess stock of great celebrity and purity, bred by Mr. Bates, was distinguished for its excellence in this respect. Some short horns in this country have yielded ample supplies of milk of excellent quality.

In selecting a bull to breed from, for good milkers, select one rather long and loosely built, with heavy body, color strawberry roan, with horns short and thick, of even size out from the head, and only tapering slightly at the end, with neck well cut up under the jaw, and with a nose tapering decidedly down from the eyes to nearly a point. For form and shape, see picture of short horn bull in volume.

James O. Sheldon, of Geneva, New York state, was a noted breeder of the Duchess, and sold his whole herd to Walkolt and Cambell, of New York Mills. They bred this same herd until they had 100 in all, then they sold them for between $300,000 and $400,000.

One cow, a pure bred short horn, owned by Isaac Ford, of Tompkins county, New York, gave 36 quarts per day, and was milked three times a day. Another cow, owned by Philip Stephens, of Ithaca, New York, made 19¾ lbs. of butter per week throughout the season. The writer sold a pure short horn cow, bred from the Sheldon stock, that gave a bushel of good milk a day throughout the season, and was milked until she was 17 years old. Her grand sire was Bow of Oxford and was bred by James O. Sheldon.

The Hon. Lyman E. Murdock, of New York state, bred and raised a pair of shorthorns. He sold them to some New York City people for $800. Three weeks later he discovered that they were being exhibited in New York City, and went there with the idea of buying them back again. He met with no success, for the men who bought the cattle would not sell at any price. It was said that they charged 25c. admission and took in $100,000 during the New York exhibit. The cattle were then 7 years old and weighed 8,000 lbs., being at that time the heaviest cattle in the world.

The backs of these animals were so broad that a half bushel of shelled corn could be turned onto them between the hip bone and not a kernel would spill off.

They were kept on ground feed, both summer and winter, from the time they were calves, and were also pastured out the same as other cattle. They were broken when calves to the yoke and were used to haul hay when very young.

They were finally shipped to London, where they were slaughtered for beef, and their meat was sold for 75 cents to a dollar a pound.

Other Types.

Of course there are many other breeds, but we shall only mention a few.

The Devons make the best cattle for working purposes, for they

are quick walkers and of a good disposition, and the cows of this family give a very rich quality of milk. The Guernsey and the Jersey, while small in size, are noted for the exceeding richness of the quality of their milk, their butter is of a golden color, hardness of texture and of a nutty flavor.

The Holstein cattle are large and well developed, they make good beef cattle and the cows are noted for the very large quantity of milk which they give.

One imported Ayrshire cow, Jean Armour, in 1862, gave on an average 49 pounds of milk a day, for 114 days. Her milk made two pounds of butter per day. Some of this breed of cows have yielded 16 pounds of butter per week for weeks and weeks in succession.

Beef Cattle For Market.

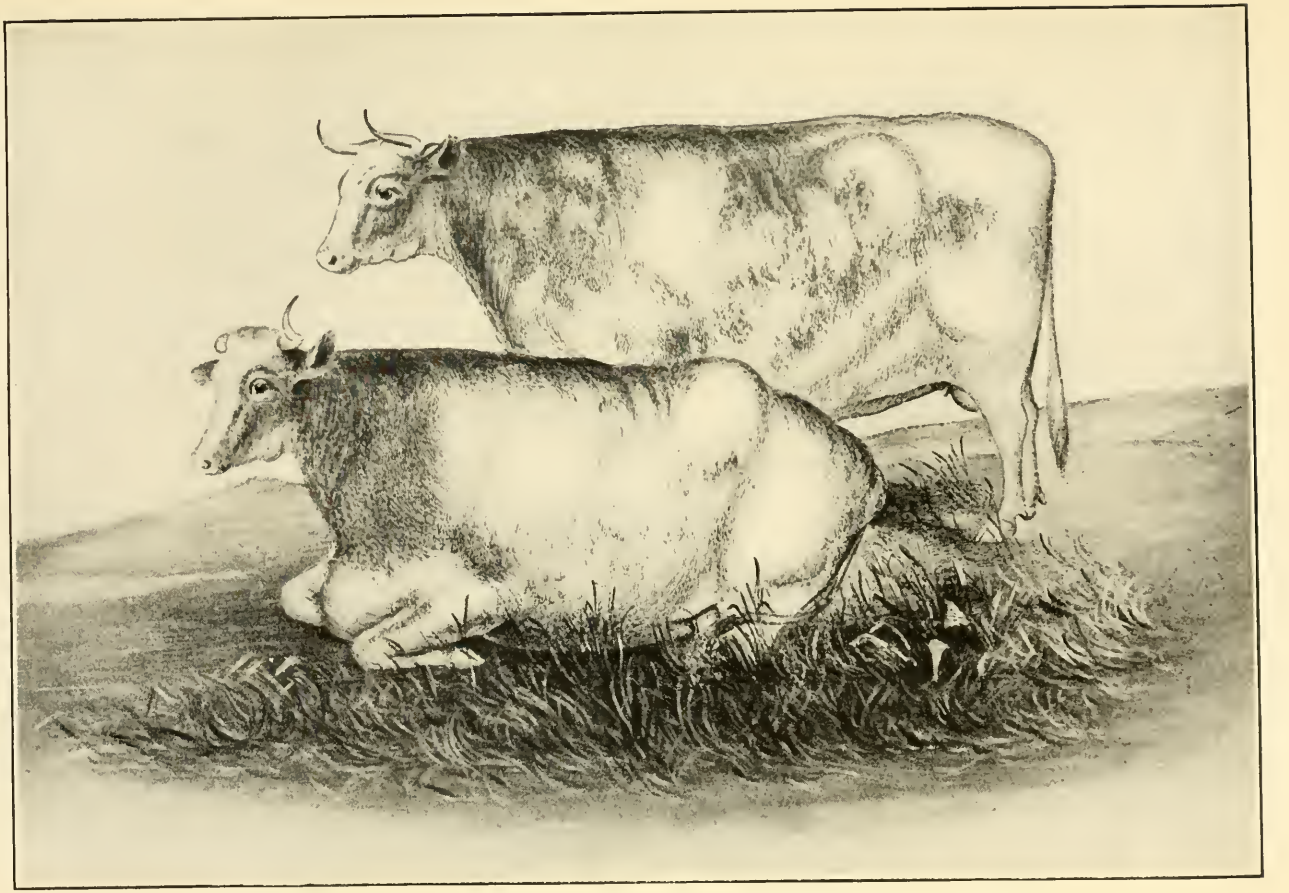
A large percentage of our beef cattle are slaughtered too young, many of them just as they are beginning to take on flesh.

A well bred steer, if he be fed and cared for as he should be, will, after the second year, take on flesh and increase in weight one-third more than any one of his first two years. This is true until he is four years old. Previous to his third year the food materials go into making up his bones and tissues, and if his feeding is rational he will have a good foundation to build the flesh upon.

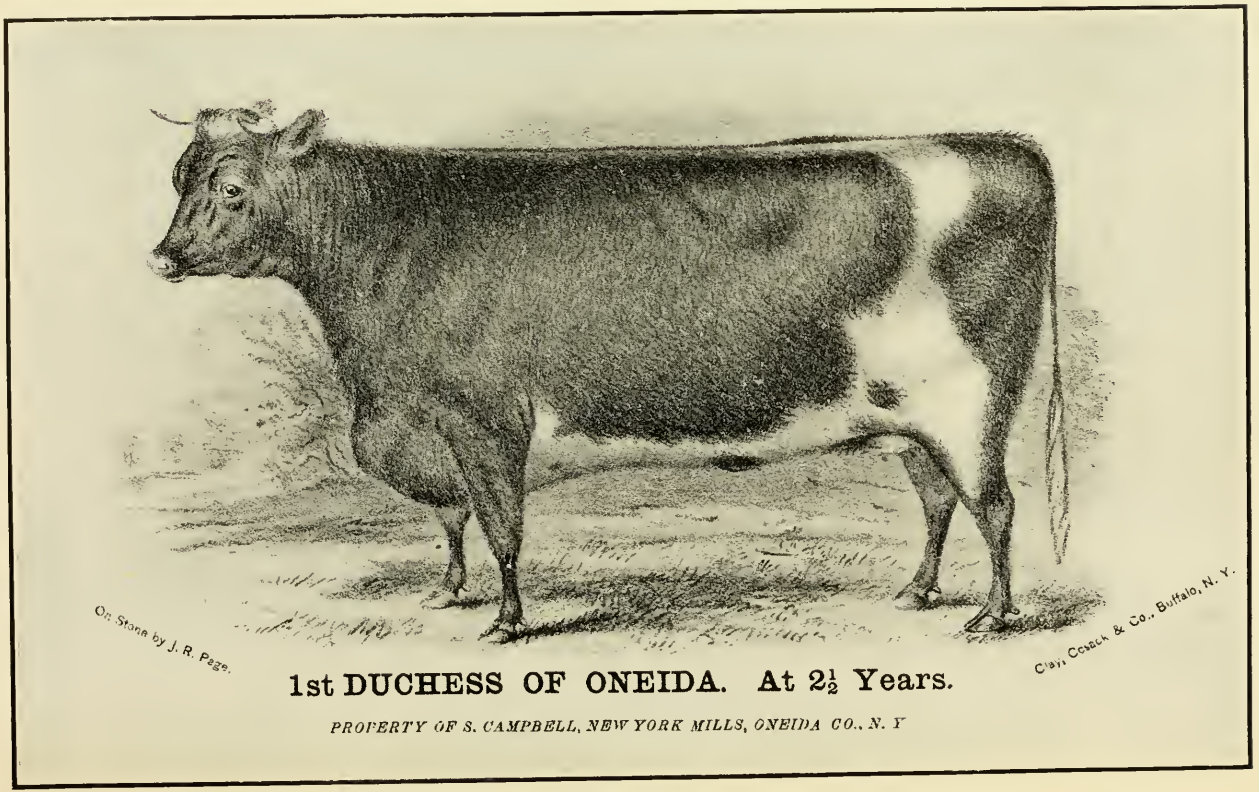
It is a well known fact that the better bred an animal is, with few exceptions, the better will be the beef and the price received. Care should be taken in feeding. A good pasture with several varieties of grasses and good water is needed for summer. In the winter use early cut clover hay, sliced mangle wurtzel beets and a mixture of farm grains ground up. Plenty of salt mixed with mashed charcoal will keep them in prime condition and when they are four years old they will weigh from 2,000 to 2,200 lbs.

Many farmers think that the sooner they can get their animals on the market the more saving of feed they can make. This is a bad mistake. If you wish to make your farm produce well feed your grain to the stock.

The writer sold stock, fed in the above manner, for $9.00 a hundred on foot.



This mammoth pair of Shorthorn oxen at 7 years of age weighed 8000 lbs. Bred by Lyman E. Murdock, Venice Center, Cayuga Co., New York.



1st DUCHESS OF ONEIDA. At 2½ Years.

PROPERTY OF S. CAMPBELL, NEW YORK MILLS, ONEIDA CO., N. Y

The Heifer was sold at auction for the sum of $25,500.00.

CHAPTER XVIII

Dairying

A very complete treatise on dairying will be found in this chapter, as it is formulated from papers from the best dairymen of eastern states, Wisconsin and Minnesota, and written by one who has had wide experience in this line.

Selection and Breeding.

1. Select the best cows that you have in your herd, or that you can buy, and dispose of the others.

2. The best cow for dairy is the one that produces the greatest amount of butter fat in a year (for food consumed), when being rightly fed.

3. It is a good plan to test your cows by weighing the amount of milk produced by them in a year. In this way it is possible to know how much butter fat each one produces.

To renew or increase your herd, raise the heifer calves from your best cows.

4. Use the very best dairy-bred sire you can get! One that has a long line of ancestors that have been first class dairy animals. It is not profitable for a cow to go dry more than four to six weeks, but the young cows should be watched and not allowed to acquire the habit of drying up too soon.

5. Keep a record of the time when the cows are bred, and allow no guess work about the time of calving.

Provide a roomy box stall and allow the cows to become accustomed to it a week prior to calving. The udder should receive prompt attention and the calf should be permitted to nurse its mother for two or three days. After separating the calf from the mother, feed the natural milk as soon as drawn, for a week or ten days. Then begin gradually to substitute skim milk with oil meal jelly stirred into it.

Feed three times a day and not more than three quarts at a time until the calf gets started.

The man whose ideal of a cow is high, and who practices good care, feed and gentleness, is sure to receive in milk and pleasure the highest profit that can be had from dairying.

Care and Feed.

Begin with the calf to develop the cow. The cow must be kept comfortable to do her best. She must not be compelled to work hard for food by treading all day over a scanty pasture, and she must have free access to salt. Do not drive her fast or let dogs chase her. Give her a warm, comfortable stall in the winter, with plenty of light and good ventilation. She should not be kept out of doors in cold, rainy or uncomfortable weather.

"Do by your cows as you would like to be done by yourself."

Give them plenty of pure water as often as they want it, at a temperature that suits them. They should never be allowed to wander off to places where there are sloughs with stagnant water or soft places where they would be apt to get mired.

Feed.

The better a cow is fed, up to her capacity to assimilate, the greater will be the profit.

Feed a variety of good fodders, such as clover hay, ensilage and corn fodder, all the cow will eat.

Milking.

1. Always have cows in the stable when ready to milk. It is better than to have them chase one another around the yard.

2. Have the stables clean, and have the cow clean, and be clean yourself or you cannot get clean milk. Before commencing to milk, brush all loose dirt from the sides and udder of the cow. Always milk a cow in the same manner, at the same time and speed. Any change will irritate and tend to excite her. Also milk in the same order and at the same time of day. Always milk a cow dry before leaving, but do not continue stripping after the milk is all drawn.

Milking should be done with clean, dry hands.

Care of Milk.

1. Milking should be done in clean, dry, tin pails, and should not be exposed to foul air.

2. Set for creaming as quickly as possible after milking.

3. Strain the milk as soon as drawn from the cow. If taken to the factory there should be a ventilator in the top of the can and the can should be protected from the sun on the way.

Butter Making.

1. Good butter can only be made from good milk and this can only be had from healthy cows, kept on good, wholesome food with pure water to drink.

2. The best way to separate the cream from the milk is by using the separator, as this gets nearly all the butter fat.

3. The temperature of milk to separate well should be as high as 80 degrees. It separates best immediately after being drawn from the cow before it has had time to cool. Immediately after separating the cream should be well aired and cooled down to about 60 degrees and held at that temperature till slightly acid and then churned. The usual temperature for churning is from 58 to 62 degrees, but no one can tell what temperature is best for his milk until after a trial.

The churning should be done at as low a temperature as possible, and should not take longer than 45 to 50 minutes. When the butter is in granules the size of wheat kernels, the churn should be stopped, and some salt should be thrown in. Then give a few turns of the churn to make the butter float. Draw off the buttermilk and wash in two or three waters, then salt to taste. The average customer wants

Sadie Vale Concordia, Holstein, H. F. H. B. No. 32259, A. R. O. 1124. World's Champion butter cow
Brotherton Stock Farms, Deansboro, N. Y. Owned by Quentin McAdam, Utica, N. Y.

about an ounce of salt to a pound of butter. Work it once, then let it lie in a cool place from two to three hours, then rework and pack, and you will have no mottled or streaked butter.

Winter Rations For Milch Cows.

Feed for the silo, especially if intended for milch cows, should be cured. If not there will be a foul odor which will affect the quality of the milk. You cannot tell how much feed is needed by the flow of milk, for some milk will produce twice as much butter fat as other milk. The better quality of milk requires more feed to produce it. A good ration for a milk cow is as follows:

2 parts ground corn or barley.
4 parts ground oats.
6 parts wheat bran.
3 parts wheat middlings.
1 part oil meal.

This ration should be fed before the cows are milked, both morning and evening, from 4 to 6 quarts to a feed. Also in the morning feed about twenty pounds of silo feed from drilled corn silage and clover hay as much as the cows will eat up clean three times a day. In the evening before milking it is advisable to feed each cow one peck of sliced roots, such as mangel wurzel, beets or carrots. One should be careful in watering milch cows in the winter to have the water of the right temperature, so that the cows will drink sufficient water to insure the greatest quantity of milk. When possible, it is most satisfactory to water cows inside on bad days. When this can not be done, the tank in the yard should be supplied with a heater, in which a fire should be built to take the chill off the water before the cows are turned out to drink. If this is not done the cows will often go thirsty rather than drink the icy water in the tanks.

It is said that the amount of corn passing a steer unmasticated increases with the amount of feed. This excessive feeding is more than a waste of corn. It requires energy, a tax on the internal economy to masticate, digest and assimilate food even if given in the least quantity required to accomplish a given purpose. If given in a larger quantity, so large that the system cannot make the use of it that nature intended, the burden on the system is so much the heavier, and therefore corn is wasted and the animal injured at the same time. This theory confirms the belief of some animal nutrition men that it now costs twice as much to make a pound of beef as is necessary. If this is only half true the total loss in this industry alone is appalling. Corn should never be fed alone, but should be ground and mixed with some lighter grains.

Every farmer should burn his own charcoal, which should be crushed and fed. The best way to prepare the wood is to cut it up into stove lengths. When it is dry, stack it up like a chimney about one foot in height. Then stand the wood on end around the chimney, place one tier on top of the first and so on till the pile is rounded off as a wood stack. Be sure to have wood close as possible. Cover the wood with about 3 inches of straw or leaves or hay or grass, then

cover this with dirt about 6 inches deep. Start the fire through the chimney and after the fire is well started cover over the top of the chimney the same as the rest of the pile. Care must be taken that fire does not break out or the whole will burn into ashes. A close watch must be kept night and day till it has burned out, which may take a week or more, as the larger the pile the longer it takes. Never open it up before you are sure that the fire is all out, as a spark left in the coal may consume the whole pile when exposed to the air. Any kind of wood may be used, yet hardwood makes the best coal.

Silo and Silage.

There is no longer a doubt that the silo is the greatest factor in reducing the cost of the winter ration for our dairy cows. Probably more than 90 per cent of dairymen who begin to use silage continue to put it up year after year. This alone should be sufficient proof that the silo is a success. A man in southern Minnesota who has a dairy of 60 to 70 cows, built two silos, 16x30 feet, in the summer of 1901. After feeding the contents of these silos he remarked that the investment had saved him a thousand dollars. The silo will do more to reduce the cost of feeding cows than will any other method we may adopt.

Construction of the Silo.

The silo which I will describe is circular in shape. The foundation is dug about two feet deep or so that it reaches below the frost line. Stone, gravel and Portland cement were used for the foundation. On top of the foundation was placed a circle of oak boards, 1 inch thick, two thick lapped to break points, and sawed so as to lay to form a circle a scant 12 feet in diameter on the inside. These one by six pieces were nailed together and laid in cement to form a smooth base for resting the staves on. White pine staves were used of two lengths, 12 and 16 feet, and 5 inches wide and 1¾ inches thick. The silo was 28 feet deep. Ten hoops made of ⅝ round iron with ¾-inch ends threaded 8 inches, were used. Late in the season, after the silo was filled, a roof was put on, which was almost flat and can be easily removed at any time.

Cost of Silo.

Lime and cement for foundation	$5.00
Mason labor	3.60
Staves	70.70
Four 4x6's, bored for hoop supports	5.20
Circle of oak for sill	3.10
Ten hoops	10.00
Staples and nails	.30
Roof (lumber $5, tin $6)	11.00
Labor 2 men 4 days	10.00
	$118.90

Capacity of silo, sixty-two tons.

LADY FRAGRANT, Pure bred Shorthorn. Bred by and property of Thomas C. Booth, Esq., Warloby, England.
Winner of twenty-three cups and first prizes.

The Cow For Small Farm Or City.

A first class dairy cow for the small farmer or city people can be had by crossing a thoroughbred Ayrshire sire and a thoroughbred Jersey cow. The pedigree of sire and dam should extend back to ancestors for dairying purposes. A thoroughbred Ayrshire bull and a thoroughbred Jersey cow with a pedigree extending back to ancestry of the short horn cattle are the best to produce the all-purpose cattle for the large farmer. A cow thus procured has a value far above all other breeds; in fact, no other breed can for a moment be considered its equal. They are a great dairy breed. While it is true that the dairy qualities of the short horn have been neglected, I have bred short horn cows that gave 32 quarts of milk per day which contained a large per cent of butter fat. By crossing these two breeds, viz., a great milk giver and a great butter maker, the dairyman will have a gold mine of his own. Cows thus produced made 18¼ pounds of butter per week throughout the season of 1908.

The Ayrshire are, as a rule, most excellent for milk and butter. The Jersey gives a rich, small mess of milk. By crossing the Ayrshire with the Jersey, and also with the Guernsey, the quantity and quality of the milk will be largely increased and the calves will make much better veal for the market.

It has been estimated that the average cow yields approximately 160 pounds of butter per year, while under properly applied scientific breeding and management 200 pounds of butter can be made yearly.

The quantity of milk and butter secured from a cow and its cost of production must, of course, depend upon the care and feed used.

On the other hand, when the city people can get the farm produce direct from the farmer, fresh and sweet, they are very glad to receive and pay a good price for it. I have been asked by city people if I knew of a farmer that would furnish a private family with poultry, fresh eggs, butter, milk, etc., by the year, as they were willing to pay the farmer's price. Milk is sometimes furnished to families by milkmen and from large dairies that is not fit for use, and often contains tubercle bacilli from tuberculous cattle. The wide spread of tuberculosis among dairy cows and the concealed character of the disease make it impossible to be sure that a cow is free from tuberculosis until she has been proven so by the use of the tuberculin test. Now for the protection of the public health it seems very necessary that regulations should be made requiring that either all milk should be obtained from cows entirely free from tuberculosis, stabled, milked, pastured, etc., in an environment free from tuberculous infection, or that it must be sterilized before it is used as a beverage or in the manufacture of butter and other dairy products. The tuberculous cow is a serious menace to the public health.

Dairy Notes.

The best cow for dairy is the one that produces the greatest amount of butter fat in a year (for food consumed), when being rightly fed.

A famous Holstein cow, owned by Mr. Schilling, of Northfield,

Minnesota, closed her official seven and 30 day test by making a new record for Minnesota. She was 6 years old and gave in one day 108.9 pounds of milk and made 4.46 pounds of butter. In seven days she gave 747 lbs. of milk and made 29.43 pounds of butter.

The only correct way to ascertain the work of a cow is by the use of the scales and the Babcock test, which must be continuously used for one year.

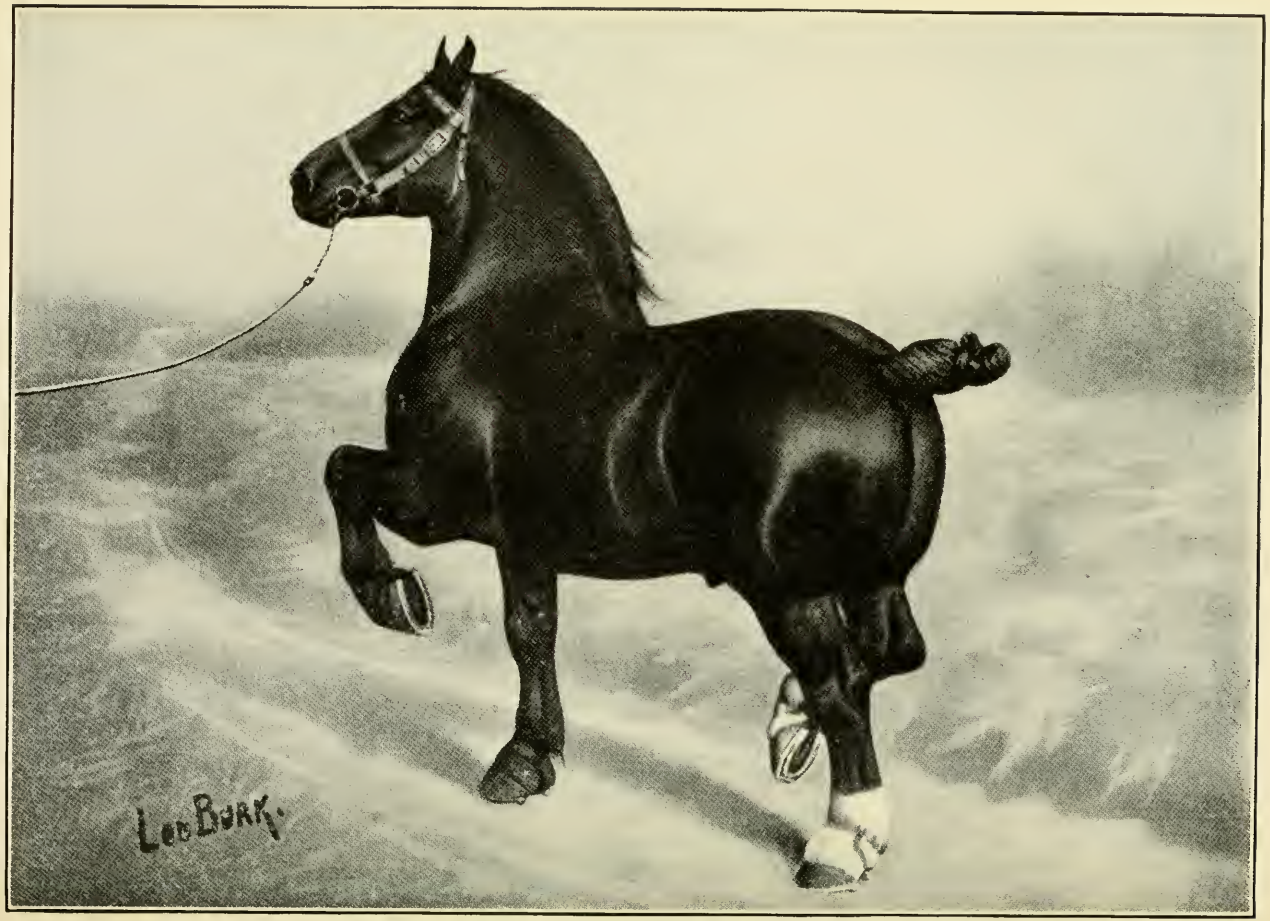
Read current dairy literature and keep posted on new ideas.

Provide water in abundance, keep it accessible and always pure, fresh, but not too cold.

Feed liberally, and use only fresh, palatable feed stuffs; in no case should decomposed or moldy material be used.

Cornell Station, Utica, New York, at the present time, has a dairy cow, pure bred Holstein, that produced 36 pounds of butter in one week.

It is not so much the amount of butter fat a cow produces as what it costs to produce it that determines the profit.



Highest priced Imported Drafthorse ever sold. This Black Percheon was purchased by Armour & Co.
Imported to America by the McLaughlin Bros.

CHAPTER XIX

Horse Department

Horse Breeding and Horse Lovers.

HORSES have been the companions of man since the beginning of time. Many men have declared that the horse is next to man in intelligence. Rev. T. Dewitt Talmage said, "There ought to be a heaven for horses." George Washington (the father of our country) was much devoted to his horse.

Ex-President Rutherford B. Hayes, who lived at his home near the little Ohio town of Fremont, on a farm, used to enjoy his broad acres by walking over them, or when on his favorite horse "Whitey" he would ride for miles and miles. "Whitey" was the horse that carried him through the civil war. He also regarded the trees on his farm with an almost paternal fondness, knowing as he did the individual history of each one. The closest friend of Ex-President Pierce was "Ethan," his horse. This horse, the farmer president used to say, was more sympathetic than many of his human friends. One day Pierce was traveling alone, in a buggy, drawn by "Ethan," when he noticed a thunder storm approaching, he said, "We must be jogging along, Ethan, or the rain will catch us." Without another word or slap of whip or rein Ethan broke into a run for home, and President Pierce always maintained that the horse understood what he had said. Who doubts it?

Gen. Robert E. Lee was very fond of his horse, which he rode through the Civil War. When he died, and his body in the casket was brought forth, covered as it was with flowers, the old charger, which Lee had loved so long, was led up beside the casket as they were bearing the body away for burial. The horse put its face down upon the casket and gave a loud whinny, by which he showed that he understood and was sorrowful.

It is an admitted fact that "kind and gentle treatment makes a kind and gentle horse." Therefore a severe whipping may forever ruin a horse of fine blood and highly nervous organization. Let good sense be used then, teach the horse by patient firmness as you would teach a child to walk, talking pleasantly and encouragingly and caressing him frequently. Give him an occasional lump of sugar, and he will soon learn to love you and a lasting friendship will be established to the credit and advantage of both horse and man.

The Percheron-Norman.

The Percheron is an improved variety of the old Norman war horse that was used by knights in early days. They are natives of La Perche, in the northwestern part of France. They stand from 15 to 16½ hands high, and are almost always gray. They are strongly

built, with heavy shoulders and powerful hindquarters, large joints, sound, big, bony legs, and excellent feet. This breed of horses are thought to be a cross between the Arabian and the old Norman draft horse. The district of La Perche has long been celebrated for superior horses. The breeders naturally seek to retain the activity of the Arabian and the strength of the Norman. This can be effected by crossing a particular kind of the Arabian stallion with Norman mares. It has been estimated by those engaged in the business that several hundred Percheron stallions have been imported into the United States within the last two years. As this breed possesses most of the qualities of strength and activity, and the form to use these gifts to better advantage than any other breed, it follows that in a few years we shall be in the possession of a very superior class of working horses. In regard to the origin of the Norman war horse, from which the Percheron sprung, there is nothing positively known. They have existed in France for centuries, and have fixed characteristics that show that they must have been bred in the animal for many generations. The Normans have formed the basis of every draft horse that has existed in Europe or America since the foundation of the breed.

The American Trotter.

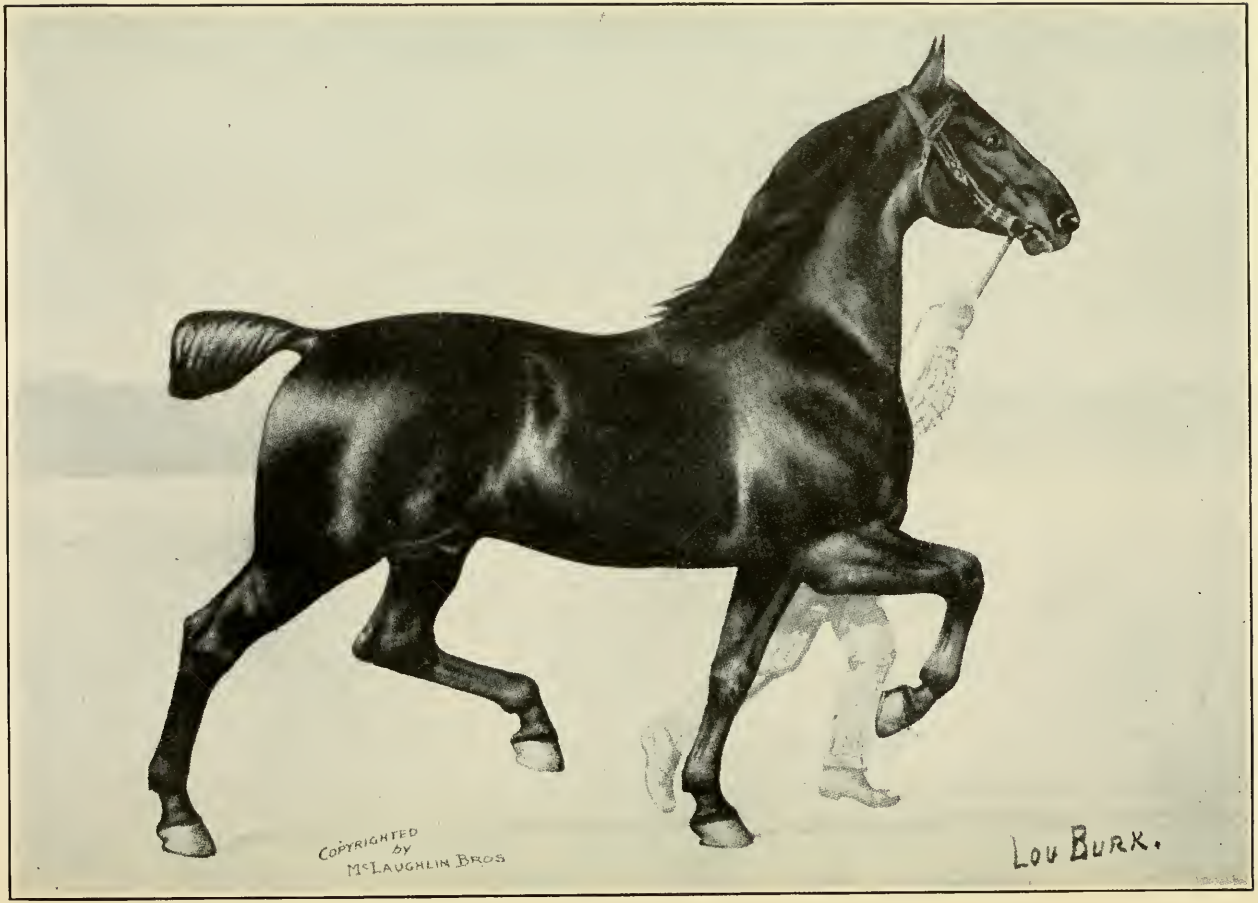
That "blood will tell" in the breeding and development of the trotter is conclusively shown by the history of the origin of the different trotting favorites. It is a fact that nearly all trotters of any degree of speed trace back to some recognized strain of blood, and while there may be exceptions, where no definite traces can be made, yet the presumption is that the pace came by inheritance and not by chance. These facts coincide with the laws of heredity. This being the case, it is interesting to study the origin of the numerous trotting families and their branches, in America, and follow their record of increase and development.

The Father of Trotters.

The father of nearly all our trotting families was the imported horse Messenger, brought from England in 1788 and taken to Philadelphia. The lineage of this noble sire traces back in the male line to the Darley Arabian, the sire of Flying Childers, but with a suspicion of an out-cross through his great grandsire Sampson. On the side of the dam the strain reaches Cade, by Godolphin Arabian.

All accounts concur in representing Messenger as being a horse of very superior, though not of handsome form, and possessing extraordinary power and spirit. Three other horses imported at the same time had to be assisted and supported from the ship, while Messenger, with head up, tail extended, charged down the plank, carrying a negro on each side, whose combined strength failed to check him until he had trotted some distance up the street.

His color was gray, which became lighter with age; he was fifteen hands three inches in height, with a large bony head, and a rather short, straight neck. His windpipe and nostrils were nearly twice the usual size, while his withers were low and shoulders upright, but deep and strong. His loins were strong, and the quarters were very mus-



French Coach Stallion. First prize winner in his class in both Europe and America.
Imported to America by the McLaughlin Bros.

cular, while his hocks and knees were unusually large, yet the common bones were flat and clean. He carried his legs under him and was always ready for action.

This description shows but little of the form of the thoroughbred, yet is typical of the form of his trotting descendants. This form, as well as the extraordinary vitality and endurance peculiar to him, he impressed upon his progeny, which being persistently driven and trained to trot, became more intensified and habituated as to gait, until we have as the result of this skill of man, and this strain of blood, the final development of the "trotting horse of America," unrivalled and unapproached in his achievements on the turf.

Messenger died on Long Island in 1808, at the age of 28, after having lived in the vicinity of New York City for 15 years. The roadsters and trotting horses throughout that section show the impress of his blood.

Prominent Sons of Messenger.

The following were the prominent sons of Messenger, to whom we trace many pedigrees: Mambrino, Bishop's Hambletonian, Ogden's Messenger, Engineer, Commander, Winthrop Messenger, and Mount Holly. Some of his daughters have contributed to the different families qualities which have given them prominence. The grand dam of Young Bashaw, the source of the Bashaws and the Clays, was a daughter of Messenger. We will trace some of the sons and their descendants to more modern times, commencing with

Mambrino's Descendants.

Abdallah.—Of this king of stallions, "rough to look at," a son of Mambrino out of the mare Amazonia, and grandson of Messenger, too much cannot be said. While he was alive he was not appreciated; in fact, was so neglected that he yielded no profit in the stud, and was sold for thirty-five dollars to a fisherman, who, not being able to work him on account of his temper, allowed him to starve to death. His greatest laurels were reaped years afterwards through the honors bestowed on his son. During late years his blood has been highly prized in pedigrees, either through male or female line.

Wm. M. Rysdyk's Hambletonian.—This son of Abdallah was the greatest progenitor of trotters the world ever saw. He was foaled in 1849 and died in 1876. His dam was by imported Bellfounder, and his second dam by Hambletonian, son of Messenger, and third dam by Messenger. Thus he possessed Messenger blood on side of dam, as well as sire. He sired 1,325 colts, and his services paid his owner over $100,000. Among his sons that have made a reputation are the stallions Volunteer, Alexander's Abdallah, Messenger Duroc, Happy Medium, Jay Gould, Walkill Chief, Geo. Wilkes, and Edward Everett, while the trotters Dexter, Nettie, Gazelle, Mattie and others are found among the lower records. He was the grandsire of Goldsmith Maid, Rarus, Gloster, Judge Fullerton, Almont, Great Eastern, Bodine, Powers, Dame Trot, etc.

Mambrino Paymaster.—This is another son of Mambrino, who was the sire of Mambrino Chief, out of a supposed Messenger Duroc

mare. Mambrino Chief was the sire of Lady Thorn, Mambrino Patchen, Mambrino Pilot, Ericsson, Bay Chief, North Star Mambrino, Woodford Mambrino and others.

Almack.—This horse was a son of Mambrino also, and was the founder of the Champion family, starting with Grinnell's Champion.

Descendants of Bishop's Hambletonian.

This is another son of Messenger and was the sire of Harris's Hambletonian. This horse was not only a sire of some celebrated trotters in his day, but many of his descendants are found among the low records. His blood is interwoven with the Blackhawks of Vermont, where he stood for years.

Descendants of Other Sons of Messenger.

Engineer was grandsire of Lady Suffolk and Dutchman of the early trotting days. From Winthrop's Messenger came a majority of the trotting stock in Maine. Ogden's Messenger is popularly supposed to be the sire of Tippoo, the ancestor of the Royal George family.

Mr. Edward H. Bramhall, of New York City, owned a mare of the Messenger breed that traveled 90 miles between sunrise and sunset during the summer days.

History of Trotting Performances.

The First Races of Record.

The first trotting race we have any authentic account of occurred at Boston in 1818. Boston Blue trotted against time and made a mile inside of three minutes, the exact time of which is not known. It was then considered a great performance. Previous to this there had been a growing taste for trotters and roadsters, gradually encroaching on saddle horses, but no public trials had been made. Racing horses, however, had always been popular, especially in the south. Virginia and Kentucky were the nurseries of the noted thoroughbreds. General Jackson did much to aid in improving the stock.

Six years later, 1824, Albany Pony trotted, to saddle, one mile, on Jamaica turnpike, in 2:40. The next horse we have any account of is Top Gallant, by Hambletonian. We have a more complete record of his performances than of any other trotter of that period. He was foaled in 1808 and trotted his principal races after he was twenty years old. In 1828, in a match against Whalebone, over the Hunting Park Course, Philadelphia, he trotted four four-mile heats in 11:16, 11:06, 11:17, and 12:15, or the whole 16 miles in 45:54. In 1830, when twenty-two years of age, he trotted twelve miles over the same course in 38 minutes; and in 1831 made two miles in 5:19. Betsy Baker, by Mambrino, beat Top Gallant three miles, under saddle, carrying 50 pounds, in 8:16.

It was said that she could, when sound, trot twenty miles in an hour. Trouble, by Hambletonian, trotted two miles in 5:15; and Sir Peter, by same sire, trotted three miles, in harness, in 8:16. Whalebone, another of Hambletonian colts, trotted three miles in 8:18.

DAN PATCH 1:55 The fastest pacing stallion in the world. Property of M. W. Savage.

Screw Driver, by Mt. Holly, in a race with Betsy Baker, trotted two three mile heats in 8:02 and 8:10.

About this period the length of the heats began to be reduced to one mile, instead of the longer races, until at the present time it is rare to hear of any thing else. In 1834 Edwin Forrest trotted, under saddle, one mile in 2:36, at Trenton, New Jersey; and on Long Island, during the same year, trotted a mile in 2:31½, which was the best time ever made up to that date. Dutchman, in 1839, made his great record of three miles, under saddle, in 7:32½, one mile of which was made in 2:28, the best time made to that date.

In 1847 Highland Maid trotted a mile, in harness, on Long Island, in 2:27. She was originally a pacer.

In 1838 Lady Suffolk, as game a mare as ever stood on iron, made her first appearance, and in 1848 made a record of 2:26, which was considered a little less than miraculous. In 1859 Flora Temple, then 14 years old, trotted a mile, in harness, at Kalamazoo, Michigan, in 2:19¾. This was without a parallel for eight years. In 1867 Dexter trotted a mile, in harness, at Buffalo, in 2:17¾. This was thought to be the lowest possible notch attainable by any horse. But in 1874 came a flyer, the "Queen of the Turf," Goldsmith Maid, who eclipsed all former performances by trotting a mile, in harness, at Majestic Park, Boston, in 2:14. This stood unrivaled for four years.

In 1878, however, that game horse, Rarus, trotted a mile, in harness, at Buffalo, in 2:13¼. This was a great record, and when we remember that they used the high wheel cart in those days and also remember the poor condition of their tracks—as compared with ours of today—we see that we are not so very far ahead of them. This horse Rarus made a brilliant career during the year 1878 and was credited as follows: Fastest mile in harness, 2:13¼; fastest first heat, 2:14; fastest second heat, 2:13¼; fastest third heat, 2:13¾; fastest fourth heat, 2:13¼; fastest three consecutive heats, 2:15, 2:13½ and 2:13¾. He may fairly be said to have won the sceptre from the old mare who held it for so many years. All this had been accomplished in one season, and in addition to this he had trotted three heats in 2:14.

Besides accomplishing the above feats he entered into a handicap race at the opening of the Chicago Driving Park, October, 1878. He went to wagon; Hopeful, one of his opponents, to harness; and Great Eastern, his other opponent, to saddle. This race was won by Hopeful in 2:17¼, 2:17 and 2:17. Rarus was privately timed and made his three heats to wagon in 2:18½, 2:18 and 2:18, it being no record, however. During the same races the trotter Hopeful made three mile heats to wagon in 2:16½, 2:17 and 2:17—the fastest time to wagon on record. During the first heat he had a running horse accompanying him part way.

It is interesting to note the growth of the trotting element during the past few years, as well as to observe the lowering of the average time of mile heats. In 1872 there were ninety-six horses who had made a record of 2:30 and better; in 1873 there were one hundred and six; while 1874 had one hundred and fifty-three; in 1875 the number was one hundred and eighty-four; in 1876 it was two hundred and

twenty-five; in 1877, two hundred and eighty-four horses made records of 2:30 and under. Of the latter number, two hundred and sixteen were in 2:25 class, one hundred and six in 2:23 class, thirty-three in 2:20 class, and 19 in 2:19.

Since 1877 the record has been gradually lowered, due in part to the bettering of the race track and in part to better understanding of breeding and better trained drivers. From 1878 to 1908 we find horses trotting as follows, to wagon:

20 miles, Controller, in San Francisco, Cal., 1878; time, 58:57.

3 miles, Ed Bryan, in Point Breeze, Philadelphia, 1905; time, 7:30½.

2 miles, Ed Bryan, in Point Breeze, Philadelphia, 1907; time, 4:43.

Best 2 heats, Lou Dillon, in Memphis, Tenn., 1903; time, 2.04¾.

1 mile in a race, Lou Dillon, in Memphis, Tenn., 1903; time, 2:04¾.

1 mile against time, Lou Dillon, in Memphis, Tenn., 1903; time, 2:00.

The world's best trotting records:

1 mile, Lou Dillon, in Memphis, Tenn., 1905; time, 1:58½.

1 mile, Cresceus, in Brighton Beach, N. Y., 1901; time, 2:03¼.

1 mile on ½ mile track, George G., in Allentown, Pa., 1907; time, 2:06¾.

Best 2 heats, Sweet Marie, in Syracuse, N. Y., 1906; time, 2:03¾.

The world's best pacing records:

1 mile, Dan Patch, St. Paul, Minn., 1906; time, 1:55.

1 mile, Prince Alert, New York, N. Y., 1903; time, 1:57.

1 mile, Dariel, Memphis, Tenn., 1903; time, 2:00¼.

1 mile in race, Star Pointer, Springfield, Ill., 1897; time, 2:00½.

1 mile, Minor Heir, Lexington, Ky., 1908; time, 2:00½.

Pacing to wagon:

1 mile, Dan Patch, Memphis, Tenn., 1903; time, 1:57½.

1 mile, Angus Pointer, Memphis, Tenn., 1904; time, 2:04½.

Arabian Horses.

A thoroughbred horse is one which traces back to Arabian blood.

There was a law which forbade the transportation of the Arabian mares to any other country. If any of these mares were ever sold the penalty for this offence, according to the Arabian law, was a long term in prison.

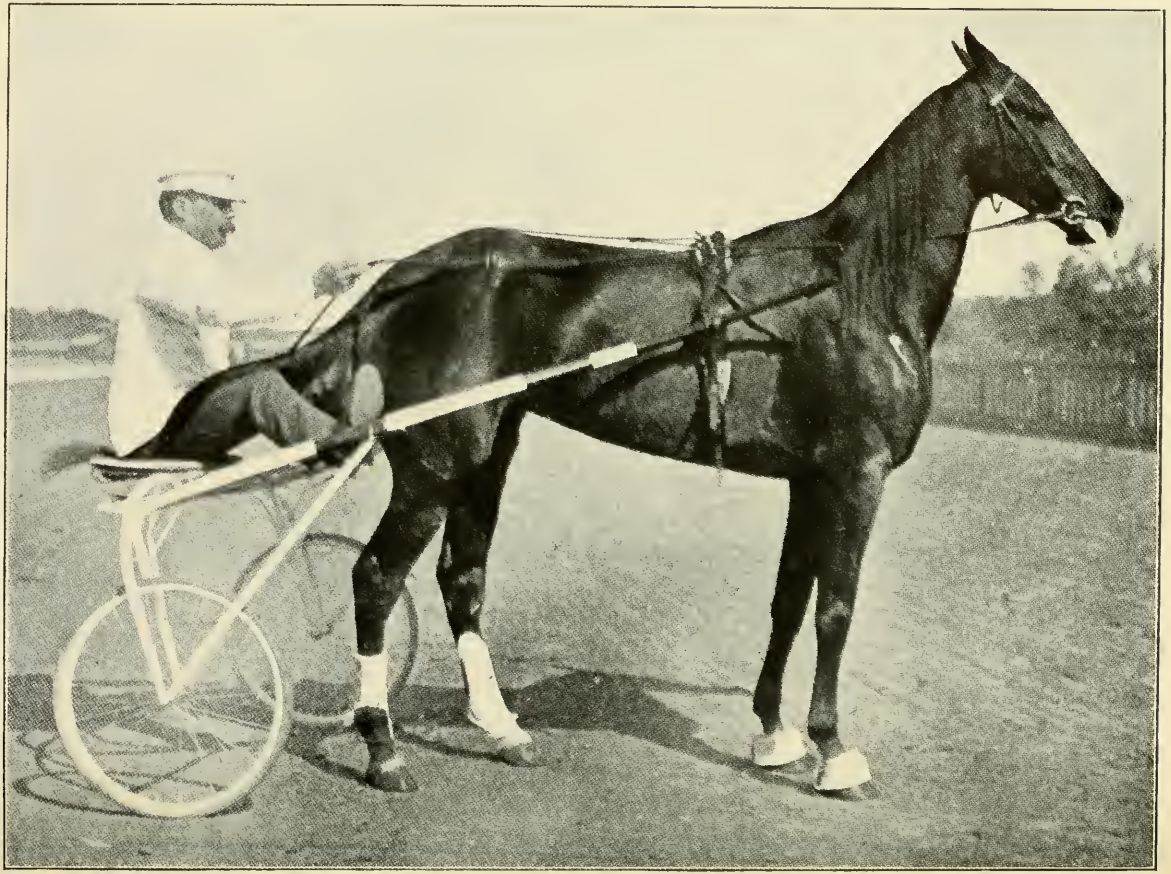
The Arabian blood flows in the veins of the fleetest horses in the world, according to the time test.

The only horses ever known to be taken from Arabia to other countries were the sires.

The writer at one time owned, drove and worked some of these horses whose dams descended from trotting families. Their sires were imported horses, Gray Percheron and Clydesdale.

Stock Needed On the Farm.

The farmer should have at least 3 working horses, weighing together 4,400 lbs., or an average of 1,400 lbs. each, and every farmer should keep a general purpose horse.



Lou Dillon 1:55 The Trotting Queen. Property of Mr. C. K. G. Billings.

A thoroughbred mare should always be kept on the farm for the purpose of raising colts, and also thoroughbred sires should always be used for improving all kinds of farm horses and farm stock in general.

The General Purpose Horse On the Farm.

This horse should be bred for quickness of action; a fast walking gait that can travel 5 miles an hour when not loaded. Such horses have been bred in the eastern states by crossing mares that can be traced back to trotting families such as the imported horse "Messenger," Hambletonian and the Morgan families can be improved by breeding mares or dams to imported sires, such as the gray Percheron. A cross between the Arabian horse and the old Norman draft horse makes the latter much quicker in speed and also renders it very much more stylish of gait. The predominant color is the dapple gray inherited from the Arabian blood. Also the imported Clydesdale sires, when bred to American mares whose pedigree is traced back to the noted trotting families, produce a wonderful cross. These horses become fully matured when 5 years old and weigh from 1,300 to 1,400 lbs., and some of them have been known to trot a mile in four minutes.

Raising and Breaking Colts.

Farmers should note the scarcity of horses and give more attention to the raising of colts. The east has for a number of years past depended on the west for their supply of farm horses. And as the great western ranches are being changed into grain and fruit farms this will make the supply of farm horses very short. A good farm team of horses brings from $500 to $600 at present and a colt may be raised for about the same amount of money as a cow, but at three years old, is generally worth as much as three or four cows. The colts should be from sires and dams that are of good ancestors, free from any diseases, such as lung trouble, heaves, etc. The mother should have ample stable accommodations when needed, and as the profit of raising colts is so large, and the demand for them is becoming so great, the farmer should keep the mares which are kind and good to work on the farm, and also because they are the best for breeding business.

The best feed for the brood mare is good oats, barley and hay. The dam and colt should be fed the same kind of grain until the colt is three or four weeks old. The first winter's feed for the young colt is early clover hay, cured and placed in the barn before rain falls.

The colt should also be liberally fed with oats and wheat bran. This will increase its development and growth. The stable for dam and colt should be warm and have plenty of sunlight and be bedded with plenty of dry straw. There should also be a yard so that the young colt may have exercise on pleasant days. It should have a good brushing every day, and plenty of salt and charcoal mixed together and placed in his feed box. A very good feed for young colts the first winter after weaning them is fresh cow's milk.

Breaking Colts.

A halter is put on the colt when 10 days old, and whenever the mother is driven the colt is led at her side. I have never found any trouble in teaching a colt to lead in that way, and long before it is weaned it will be perfectly halter broken.

Bitting the Colt and Training To Harness.

In the warm days of spring when the colt is a year old, let the bitting process be commenced; and if the colt has been handled from his birth he will usually submit to the bitting process as quietly as he will to any other training. After putting on the bitting fixtures he should be turned loose in a safe yard and given an hour or so to become familiar with the harness. He should be checked up gradually until the proper carriage of the head is attained. After a day or two a cord 10 to 12 ft. in length may be tied to the bits and the colt allowed to train or exercise in a circle or around you. This should be gone over time and again, and when he is two years old he may be harnessed and hitched beside his mother and driven quietly about, at first with only the harness on, then to a light carriage. From 3 to 4 years old a colt should be driven with exceeding care.

Diseases and Remedies.

This chapter does not attempt to give any but the most common diseases and remedies. When possible it is always best to get a reliable veterinarian. However, it is often possible to give the animal temporary relief before professional assistance arrives.

How Medicines Are Applied.

Medicines are applied in any one or more of the following ways:

1. Through the mouth. By means of pills, powders or drenches. If giving by drench use the drenching bottle, or a strong ale bottle will answer. If the medicine is very strong, as turpentine, add enough oil or milk beaten with eggs to prevent irritating the membranes of the mouth and throat.

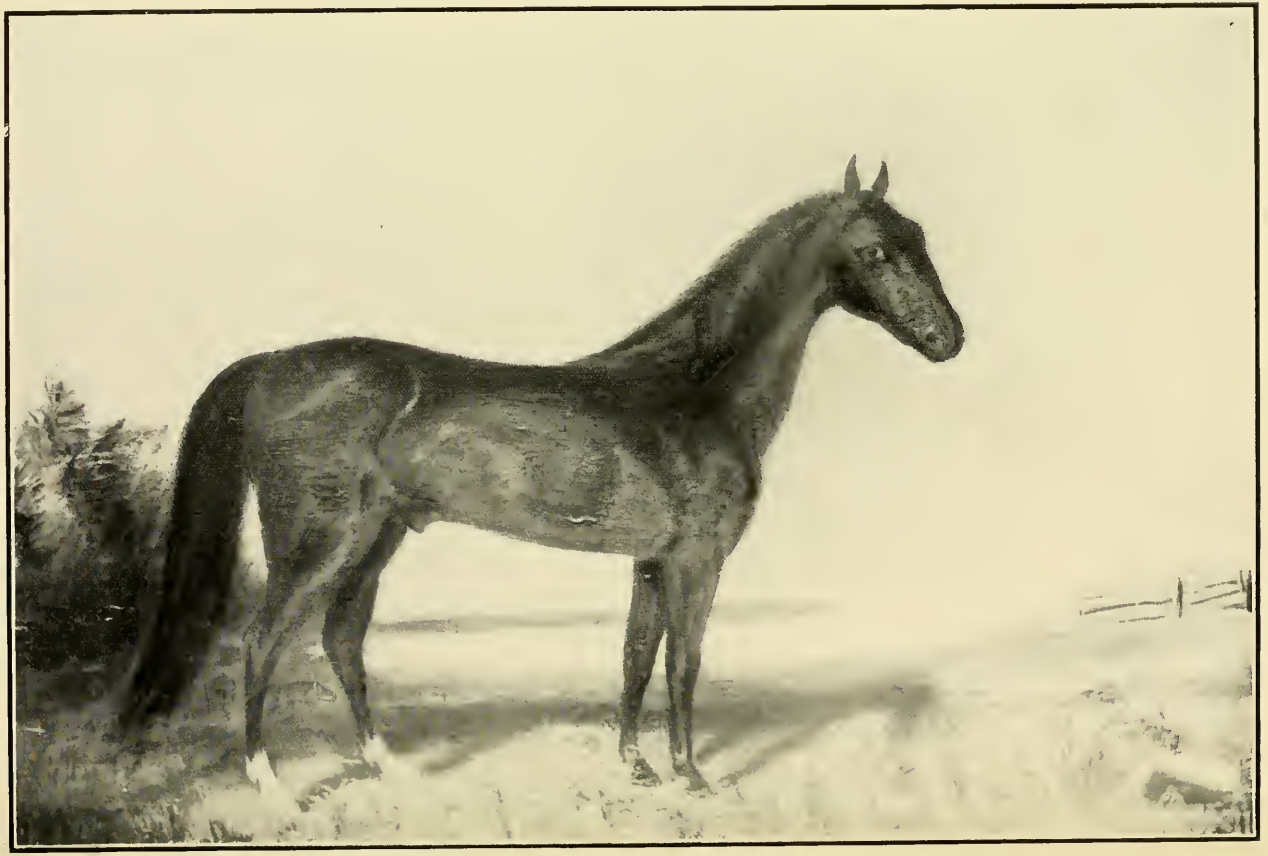
2. Through the nose. The most common form is simply the inhaling of medicated vapors. For this, a sack is hung over the horse's nose and steam is introduced into it. Holes must be cut opposite the animal's nostrils, as the vapor must not be too hot. Vinegar and water or scalded bran, in which carbolic acid has been put, are very good for inhaling for troubles in the lungs and throat.

3. On the skin and under it. On the skin, as poultices, etc., and under it, by means of the hypodermic syringe.

4. Through the rectum. For worms in bowels, to move the bowels and intestines, for injections and when medicines cannot be given through the mouth they are administered through the rectum. Do not use a pump to give an injection. A better way is to use a hose and funnel.

Toothache Or Decayed Teeth.

This is rare, but if found it is from decayed teeth and is caused by biting something hard and breaking off some part of the tooth. It



Wm. M. Rysdyk's Hambletonian. This son of Abdallah was the greatest progenitor of trotters in the world.

can be detected by the action of the horse. When eating or drinking he will suddenly stop and throw his head to one side as though in pain. Sometimes bad odors in the mouth indicate trouble.

The bad tooth can be located by tapping with a small hammer until the horse flinches. The extraction will require a veterinarian.

Broken Wind Or Heaves.

Do not use an animal in this condition for breeding.

This is quite common and though the locality of the disease is known, much difference of opinion exists as to the cause.

The symptoms are well defined. The double movement in the flanks when coughing and the inflated nostril and short cough or wheeze. This is worse during close, damp weather. If the animal has been "doped" by tricksters the symptoms can be shown up by watering well and then driving up a steep hill or on a hard road.

Treatment.—There is no cure if once deep seated, but care in feeding will help. In early cases more good can be done. Water always before feeding. Then dampen the hay, which should be the best obtainable. Feed this with grain, such as corn or oats mixed with some root chopped fine, as carrot, potatoes, etc. Do not work right after eating. Pasturing relieves the horse. Dr. Geo. A. Waterman, of the Michigan State Agricultural College, gives the following remedy:

Arsenic and hydrochloric acid in solution (liquor arsenici hydrochloricus): give 1 tablespoonful with bran or oats 3 times a day for 2 weeks; then twice a day for 2 weeks; then once a day for several weeks.

Diarrhoea is caused by exposure to cold, low, damp stables, musty food, stagnant water, etc.

Treatment.—If from any of the above causes they should be located and removed. If caused by some irritation in the intestines, give a quart of oil and the trouble will gradually disappear.

Should it still continue, give starch water, or water in which scorched wheat flour is put.

In very severe cases give the following: Corrosive sublimate, 5 grains, water, ½ pint, every 2 hours until relieved.

Worms and Bots.

There are three kinds of worms:

1. Long round, 4 to 12 in. in length.

Treatment must be vigorous. Use 3 times a day arsenious acid, 5 to 10 grains, for ten days, beginning with the small dose and increasing to the largest. On the 11th day give linseed oil, 1 pt., and croton oil, 30 drops. Shake well. Mix the arsenious acid well with damp food.

2. Pin Worms. Infest the large intestines. Are noticed in the manure. Use injections through the rectum, first with water and then with copperas 1 oz., water 3 qts. Repeat every 2nd or 3rd day.

3. Tape worms are not very serious in the horse, but if found are present in the small intestines.

Fast animal for 12 to 18 hours, then give areca nut (powdered) ½ ounce, oil male fern 2 drachms, raw linseed oil ½ pint. Follow this within 2 or 2 hours by ¾ lb. of epsom salts, then feed as usual. Repeat, if necessary, in a week.

Bots.—Medical treatment is not satisfactory and if they are once in the stomach they will have to take their natural course. They loosen in May or June and are given off in the manure. Prevent the hatching of the eggs by washing them off the animal with soap and warm H_2O. Bots never eat through the stomach. They do harm sometimes by clogging the stomach.

Azoturia.—Is not well understood by veterinarians. Always occurs with overfed and under-exercised horses. Symptoms are very definite. A wellfed animal that has not been exercised is taken out and driven. After going a short distance the animal slacks up and perspires, trembles if standing, and if down cannot use hind limbs. The muscles of the loins are swollen and hard.

Stop as soon as the first symptoms show and blanket warmly. Do not try to move unless weather conditions make it absolutely necessary. Then get to nearest barn. If stopped at once the attack may be light when just a little further exercise may turn the scale. Often, just to see what will happen, the driver goes a little further, thus turning a mild into a fatal case. Send for veterinarian at once, if possible. Give following: Fluid extract of belladonna 1 teaspoon, bromide of potash ½ oz., water ½ pint. Repeat in 2 or 3 hours. Then give a purgative: 1 oz. of aloes in 1 pt. of linseed gruel, or ¾ lb. of epsom salts.

If bowels don't move freely in 24 hours, give 1 pt. of oil.

Apply hot blanket on the loins. If animal is down he must be rolled over on chest and the urine must be drawn by a catheter 4 or 5 times a day.

Prevention.—By exercising unused horses at least every other day and cutting down their rations.

Epidemic—Influenza Epizootic.

Professor Law, of Cornell University, New York, considers this a specific typhus fever, complicated with inflammation of the mucus membranes lining the air passages and less frequently of the lungs, pleura, heart, liver, stomach and bowels, and even the muscles and lining of joints. There is no doubt about its contagion.

Symptoms.—The attack is usually sudden and the horse, which one-half hour before seemed well, suddenly drops his head, ears and lips, and stands with one or two legs semi-flexed, to bring relief.

Treatment.—Its treatment consists in a warm box stall, warm blankets and laxative food. Remove costiveness by copious injections of warm water, to which may be added two drachms of aloes. Follow with liquor acetate of ammonia, 3 fluid ounces; extract belladonna, one drachm; mix. Give twice daily in a pint of water. Much more depends on warmth and care than on a great deal of medicine.

This pair of horses are full brothers. They are three-quarters Messenger and one-quarter Imported Clydesdale. Together they weighed a trifle over 3600 lbs. This team took the first prize at the World's Fair in 1876.

Distemper.

Treatment.—Distemper has about 3 weeks to run its course; all the medicine required is a light dose of epsom salts, say 4 to 6 ozs., and good nursing. Give warm bran mashes, linseed or oatmeal gruel; keep the animal warm, and rub the legs with cloths dipped in hot water; a tablespoon of mustard in the water would be beneficial if the legs seem to be weak and numb or cold.

Colic.

Take 1½ pints of lard, heat quite warm, place in a bottle and drench the horse with it. This can be used when other remedies cannot be had.

Another Good Remedy.

Give one heaping tablespoonful of soda in one quart of buttermilk. Put the soda into the buttermilk just when ready to give; repeat in half an hour, if necessary.

For Wind Colic.

Chloroform, ½ ounce; linseed oil, raw, 1 quart; mix and give as one dose.

Cribbing and Wind Sucking.

This is not a disease in itself, but an exceeding bad habit. The manger, post, fence, or other objects are caught with the teeth, and the horse bears down until the neck is altered in position so as to form a temporary vacuum in the pharynx, when air rushes in to fill it.

Treatment.—Put the horse in a box stall and feed him from the floor, giving feed from a pail that is removed as soon as empty, leaving nothing he can get hold of. A strap buckled tight around the throat—tight enough to prevent the action—is another means employed. Putting red pepper, aloes, and other such ingredients on edges of manger where horse can crib is also resorted to. Another way is to put a muzzle on with bars across the nose that will allow eating, but will prevent grasping the manger in his teeth. With young horses having this trouble give regular exercises.

Lockjaw.

Cure for Lockjaw.—Bleed in the third bar of the mouth and drench with strong, salt water.

Spavin.

Corrosive sublimate, 2 drachms; lard, 1 ounce; cantharides, 2 drachms.

This blister should be thoroughly rubbed in with the hand for about ten minutes. Twenty-four hours afterward apply a little oil or vaseline, and repeat night and morning until the blister heals.

Scratches.

Wash the affected parts with strong soap suds and apply freely Gumbault's Caustic Balsam. Have known this to cure when all other remedies had failed.

Sprains.

Sprain.—Bandage with salt and vinegar as warm as the horse will stand it.

Sweeny Or Curb.

Sweeny or Curb.—Or any hard lump, use the following liniment: Sweet oil, cantharides, hartshorn, origanum, camphor, equal parts of each.

Wounds Or Cuts Application.

Alcohol, 1 pint; camphor, 1 ounce; saltpeter, 1 ounce; gum guaiacum, 1 ounce.

Chicken Lice On Horses.

Take one quart of fresh lard, mix with carbolic acid crystals 1 drachm.

To Protect Horses From Flies.

Take the common smartweed and make a strong solution by boiling in water. When this is cooled apply to the legs, neck and other parts of the body with a brush or sponge, and neither flies or any kind of insects will trouble them within the next (24) twenty-four hours.

Sometimes chicken lice make the horses rub their manes and tails. They are very annoying to horses. Chickens should never be allowed to roost in or near the horse barns.

To Thicken the Mane and Tail of a Horse.

Wash thoroughly with castile soap and warm water once a week. Then take the common kerosene oil and mix it wth equal parts of sweet oil. Or a good substitute is mercurial ointment. Rub this into the roots of the mane and tail as often as once a week.

CHAPTER XX

Frosts and Sprays

Facts About Frosts.

THE total damage wrought in the United States by the frosts of spring and fall runs into many millions of dollars. Naturally most of this is unavoidable, but a knowledge of the conditions governing frosts, and where possible the use of proper measures of protection, would reduce this sum materially and for the individual may easily mean the difference between profit and loss.

What Is Frost?

Frost, as we all commonly recognize it, is a condensation of moisture on plants in the shape of small ice crystals. Usually the air a short distance above the earth is several degrees above the freezing point at the time that frosts occur. The plants and the earth itself, however, radiate heat very rapidly after sunset and may reach a point where the surface is below the temperature of freezing. Immediately the moisture in the air is deposited on these surfaces in the form of ice crystals.

Location.

In setting out to plant a given area, or in searching for a suitable piece of ground on which to place a given crop, the danger of frost should receive careful study. Many crops can stand heavy frosts. Naturally these may be raised in areas that are not particularly free from spring and fall frosts. Other crops which are especially tender should never be attempted except in suitable locations.

Any valley within the temperate zone that is more or less shut in at its lower end is likely to prove a settling point for cold air. On the other hand, hillsides sufficiently elevated above such valleys are protected by the very fact that the cold air drains away from them and are likely to be comparatively free from damaging frosts. Due recognition of these two facts should be made in deciding what crop to grow or what land to choose.

Factors That Influence Frosts.

It is everywhere recognized that clear, still nights are particularly apt to be frosty. The reason for this is easily found. Clouds serve as a blanket to the layer of atmosphere just above the earth and hold the heat. The radiation of heat from the earth and from plants goes on very much more slowly when the sky is overcast with clouds.

Winds tend to prevent frosts, because they stir up the air and keep it from forming in layers. If the air is kept constantly stirred by winds, the cold air next the earth will be mixed with the warmer

air above and the freezing temperature at the surface of the earth will not be reached.

Protection Against Frosts.

Anything that will serve as a blanket to assist the earth and the plants to retain the heat they have absorbed during the day will tend to prevent frost. This blanket may be water vapor, a heavy cloud of smoke, or such artificial coverings as straw, boards, earth, etc. With low-growing plants like the strawberry, straw may be used to great advantage as a protection against frost. The value of one crop saved in this way will pay for the labor and cost many times over. Garden vegetables of tender varieties may often be protected by plowing so as to cover their tops with earth.

No practical means have yet been devised for protecting extensive areas of field crops such as potatoes from frost, but in vine and tree fruits, where the value of the crop is so much greater, protective measures may profitably be employed.

Winter Protection for Large Shrubbery and Fruit Trees.

For all kinds of large shrubbery, when the canes are too large to bend in, extend the branches out some distance from the trunks. Then carefully lift the branches and bend them toward the trunk, being careful not to break in bending them. Then bind with a strong cord or burlap. Place the outer branches in position. Enclose the shrubbery with long corn stalks, standing them all around the shrub, a thickness of from 12 to 24 inches or even more, the thicker the better, then bind with cord or burlap. Bind from the ground up, the first tie being about 18 in. from the ground. Tie in the center and at the top. They should be bound together as close as possible, so as to be entirely protected from the wind and snow. The last band should be within 18 inches of the top of the corn stalks and drawn very closely together, so that no water can reach the shrub in case of a beating rain.

All kinds of shrubbery and fruit trees protected in this manner by the use of corn stalks will live through the severest weather, where they have long, cold winters and deep snows. Such shrubbery as grape vines, blackberries, currant bushes, raspberries, etc., also the peach tree can be wintered until the fruit bearing begins.

Frost and Temperature Table

PLACE	ANNUAL TEMPERATURE			KILLING FROST	
	MEAN	MAX.	MIN.	Last in Spring	Early Fall
Alabama — Birmingham	63	97	13	Mar. 4	Oct. 25
Mobile	66	97	24	Feb. 17	Nov. 19
Montgomery	64	97	19	Mar. 4	Nov. 14
Arizona — Flagstaff	45	92	–18	June 15	Sept. 15
Phoenix	70	112	25	Feb. 17	Dec. 23
Yuma	72	113	29	None	None
Arkansas — Fort Smith	60	96	3	Mar. 28	Nov. 13
Little Rock	61	96	7	Mar. 28	Nov. 13
California — Los Angeles	63	97	32	None	None
San Diego	62	94	35	None	None
San Francisco	56	101	38	Feb. 15	None
Colorado — Denver	50	97	–10	April 30	Sept. 15
Grand Junction	51	99	–15	April 13	Oct. 31
Pueblo	51	98	–13	May 3	Oct. 8
Connecticut — New Haven	48	94	–6	April 20	Oct. 25
Delaware — Newark	51	98	–10	April 23	Oct. 4
Washington, D. C.	53	96	2	April 17	Oct. 7
Florida — Jacksonville	68	97	26	Feb. 18	Nov. 27
Key West	76	93	51	None	None
Tampa	71	95	32	Feb. 18	Nov. 28
Georgia — Atlanta	60	94	12	Mar. 4	Oct. 25
Columbus	65	101	21	Feb. 22	Oct. 25
Toccoa	58	97	12	April 5	Oct. 25
Idaho — Boise	52	104	4	May 5	Oct. 30
Lewiston	45	108	16	April 12	Oct. 30
Pocatello	47	96	–12	May 8	Oct. 15
Illinois — Cairo	57	95	1	April 20	Oct. 20
Chicago	47	94	–15	April 20	Oct. 25
Springfield	50	97	–12	April 20	Oct. 25
Indiana — Bloomington	53	100	–11	April 20	Oct. 20
Indianapolis	51	94	–9	April 20	Oct. 20
South Bend	47	94	–11	May 15	Oct. 1
Indian Territory — Muskogee	59	100	1	May 1	Oct. 15
Iowa — Des Moines	48	94	–18	May 1	Oct. 15
Dubuque	46	94	–23	May 15	Oct. 25
Sioux City	47	96	–21	April 25	Sept. 20
Kansas — Fort Scott	56	100	–11	April 15	Oct. 15
Manhattan	53	102	–16	April 25	Oct. 20
Topeka	53	98	–10	May 1	Oct. 20
Kentucky — Bowling Green	56	99	–3	April 20	Oct. 20
Lexington	54	94	–3	April 15	Oct. 25
Louisville	56	98	–1	April 15	Oct. 25
Louisiana — New Orleans	68	95	27	Feb. 15	Nov. 15
Shreveport	65	97	13	Mar. 5	Nov. 15
Maine — Orono	41	89	–27	June 1	Sept. 15
Portland	43	93	–10	May 2	Sept. 25
Maryland — Baltimore	54	97	2	April 15	Oct. 30
Princess Anne	53	93	0	May 1	Oct. 20
Massachusetts — Boston	48	93	–10	April 20	Oct. 25
Worcester	47	94	–10	May 1.	Sept. 25
Michigan — Detroit	47	96	–10	May 1	Oct. 5
Saginaw	45	96	–20	May 10	Sept. 20
Minnesota — Minneapolis	42	92	–33	May 15	Oct. 5
Winnebago	44	92	–30	May 1	Sept. 20
Mississippi — Biloxi	68	98	24	Feb. 15	Nov. 15

Frost and Temperature Table (Continued)

PLACE	ANNUAL TEMPERATURE			KILLING FROST	
	MEAN	MAX.	MIN.	Last in Spring	Early Fall
Vicksburg	65	94	18	Mar. 4	Nov. 15
Missouri — Kansas City	53	97	–10	Mar. 30	Oct. 25
St. Louis	55	98	–10	April 20	Oct. 25
Montana — Great Falls	46	97	–25	May 25	Sept. 15
Kalispell	43	94	–10	May 5	Oct. 5
Miles City	45	104	–30	May 20	Sept. 15
Nebraska — Fremont	48	100	–20	May 1	Sept. 15
Lincoln	49	99	–14	April 30	Oct. 15
North Platte	49	99	–10	April 30	Sept. 15
Nevada — Carson City	48	92	–15	May 20	Sept. 15
Winnemucca	48	96	–20	May 25	Sept. 15
New Hampshire — Concord	44	95	–20	April 20	Sept. 30
Plymouth	42	97	–27	June 5	Sept. 10
New Jersey — Cape May	52	91	0	April 20	Oct. 30
Trenton	54	94	0	May 1	Sept. 20
New Mexico — Mesilla Park	60	103	4	May 3	Oct. 20
Santa Fe	49	89	–4	April 30	Oct. 30
New York — Albany	46	97	–25	May 1	Sept. 25
Buffalo	46	89	–8	May 1	Oct. 10
New York	50	95	–5	April 20	Oct. 30
North Carolina — Asheville	53	90	4	April 15	Oct. 15
Charlotte	59	98	14	April 5	Nov. 10
Raleigh	58	99	14	April 20	Oct. 30
North Dakota — Bismarck	39	99	–40	May 15	Sept. 15
Devils Lake	36	96	–40	May 15	Aug. 15
Ohio — Cleveland	47	90	–8	May 1	Oct. 30
Cincinnati	54	96	0	May 5	Oct. 25
Oklahoma — Chandler	65	101	0	May 1	Oct. 25
Stillwater	57	102	3	May 1	Oct. 25
Oregon — Baker City	46	97	0	May 15	Oct. 15
Portland	53	100	24	Mar. 1	Nov. 15
Pennsylvania — Philadelphia	52	96	–2	April 20	Oct. 25
Pittsburg	51	92	–5	April 20	Oct. 10
Rhode Island — Providence	50	97	3	April 20	Oct. 25
South Carolina — Charleston	64	98	23	Feb. 15	Nov. 20
Greenville	55	97	9	April 25	Oct. 25
South Dakota — Pierre	46	105	–20	April 30	Oct. 30
Tennessee — Memphis	60	94	6	Mar. 1	Oct. 15
Nashville	58	97	1	April 5	Oct. 25
Texas — El Paso	63	102	14	Mar. 10	Nov. 10
Galveston	68	91	24	Feb. 1	Dec. 25
Utah — Logan	46	96	–15	May 15	Oct. 15
Salt Lake City	51	98	–5	April 15	Sept. 15
Vermont — Burlington	45	90	–18	May 1	Sept. 15
Northfield	40	89	–30	June 1	Sept. 10
Virginia — Charlottesville	55	97	2	April 20	Oct. 25
Hampton	56	98	11	April 20	Oct. 15
Washington — Tacoma	50	97	22	Mar. 15	Nov. 15
Spokane	48	100	4	April 30	Oct. 30
West Virginia — Elkins	48	90	–9	May 10	Oct. 10
Parkersburg	53	95	–2	April 20	Oct. 15
Wisconsin — Madison	44	90	–25	April 25	Oct. 15
Milwaukee	45	94	–20	April 20	Oct. 20
Wyoming — Cheyenne	44	90	–20	June 1	Sept. 15
Lander	43	90	–28	May 25	Sept. 15

Spray Calendar and Formulas.

Edited by Prof. M. V. Slingerland, Entomologist, Cornell University College of Agriculture
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Explanation.—In the preparation of this calendar the most important points regarding sprays have been selected and arranged in such manner that the grower can see at a glance what to apply and when to make the applications. The more important insects and fungous enemies are also mentioned, so that a fairly clear understanding of the work can be obtained by examining the table. When making the applications advised, other enemies than those mentioned are also kept under control, for only the most serious ones can be named in so brief an outline. The directions have been carefully compiled from the latest results of leading investigators. The advice given is intended to be suggestive merely. In so brief a space it is impossible to go into details. The person who wants fuller information, should consult the Experiment Station bulletins on the special subjects.

In this calendar it will be seen that some applications are in parentheses; these are the ones that are least important. The number of applications given in each case has particular reference to localities in which fungous and insect enemies are most abundant. If the crops are not troubled when certain applications are advised, it may be unnecessary to make them at these times. When Bordeaux mixture is used on fruit trees, it will usually pay to add a poison to the spray.

It should be remembered that in all cases success is dependent on the exercise of proper judgment in making applications.

Prevention in the case of fungous diseases should be the watchword. Plant diseases are rarely cured, but they can frequently be prevented. Know the enemy to be destroyed; know the remedies that are most effective, and apply at the proper season. Be prompt, thorough and persistent. Knowledge and good judgment are more necessary to success than any definite rules. Spraying is an insurance.

Spraying is no longer an experiment. It is an accepted practice, as tillage, pruning and fertilizing are. It may not be necessary to spray every year, but the farmer should be prepared to spray every year. In case of doubt, spray.

See that pumps and rigs are in working order before plowing time comes. Order your materials. Pattern after the bugs—be ready.

Sprays for Vegetables.

Asparagus.—Rust. Bordeaux mixture as soon as brush appears, and repeat every few days. Beetles. Crush eggs on shoots in spring. Thoroughly poison the brush or leaves in summer and fall.

Bean.—Anthracnose, pod-rust. 1, Bordeaux mixture, when first true leaf has expanded; 2, 3, etc., the same at short intervals to keep the foliage covered by the mixture.

Beet.—Leaf-spot. 1, When four or five leaves have expanded, Bordeaux mixture; 2, 3, etc., the same every 10 to 14 days.

Cabbage and Cauliflower.—Aphis. 1, Upon young plants, kerosene emulsion (1 part to 6 or 8 water) or whale oil soap (1 lb. to 5

gals. of water) when insects are first seen; 2, Repeat 1 when necessary. Cabbage-worm. 1, If plants are not heading, a poison spray; 2, Repeat 1 at intervals of 7 to 10 days; 3, If plants are heading, hand-picking or hellebore. Root-maggot. Pour around base of plants an emulsion of 1 lb. soap, 1 gal. boiling water, 1 pint of crude carbolic acid. Dilute this emulsion with 30 parts of water. Club-root. Apply lime in soil at rate of 35 bushels per acre, preferably in previous fall.

Celery.—Early blight, late blight. 1, Apply Bordeaux mixture as soon as the plants have become established; 2, Repeat 1 every two weeks until the plants are half or two-thirds grown; 3, Apply ammoniacal copper carbonate solution every 10 to 14 days, or more often if the weather is rainy.

Cucumber, Melon and Squash.—Downy mildew. Bordeaux mixture every 10 days, or often enough to keep the foliage well covered above and below from the time the plants are very small until frost. Striped cucumber beetle. Keep plants thoroughly covered with Bordeaux mixture.

Egg Plant.—Leaf-spot. As soon as plants are established in the field, Bordeaux mixture; 2, 3, Repeat 1 at intervals of 2 or 3 weeks until first fruits are one-half grown; 4, Ammoniacal copper carbonate, repeat when necessary.

Onion.—Blight. Weak Bordeaux mixture (two-thirds strength) applied every 10 days from time bulbs begin to form until harvest. Thrips. Kerosene emulsion or whale oil soap, 1 lb. in 5 gals. water. Maggot. See root-maggot under cabbage.

Potato.—Early blight. 1, When vines are young, Bordeaux mixture; 2 and 3, Repeat 1 at intervals of 2 to 3 weeks (only partially successful). Late blight. 1, During middle of July, Bordeaux mixture; 2 and 3, at intervals of 1 to 3 weeks, repeat 1. Scab. Soak uncut seed potatoes 1½ hours in solution of 1 oz. corrosive sublimate in 8 gals. water; or 2 hours in solution of ½ pint formalin in 15 gals. water. Potato-beetle. When beetles first appear, a strong poison spray (1 lb. Paris green in 50 gals. water with 2 lbs. lime, or in Bordeaux mixture); 2 and 3, Repeat 1 when necessary. Flea-beetle. Bordeaux mixture and Paris green.

Tomato.—Leaf-blight. 1, As soon as disease is discovered, Bordeaux mixture or a clear fungicide; 2, 3, etc., Repeat 1 at intervals of 7 to 10 days. Rot. Spray as directed under leaf-blight (unsatisfactory in most cases). Usually better to secure many pickings by starting the plants early and giving the best culture; then if the rot comes, some pickings stand a chance of escaping. Train the vines.

Turnip.—Club-root. Apply lime in soil at rate of 35 bushels per acre, preferably in previous fall.

Sprays for Small Fruits.

Currant.—Leaf-blight. 1, When injury first appears, before the fruit is harvested, ammoniacal copper carbonate, to avoid staining the fruit; 2, After fruit is harvested, Bordeaux mixture freely applied; 3, Repeat 2 when necessary. Green currant worm. 1, When first worms

appear on lower leaves, use a poison spray; 2, Repeat 1 when necessary until fruit is half grown; 3, Use hellebore if any worms remain after fruit is half grown. Borers. Cut out and burn infested stems early in spring.

Gooseberry.—Mildew. 1, Before buds break, Bordeaux mixture; 2, When first leaves have expanded, potassium sulphide; 3, 4, etc., Repeat 2 at intervals of 7 to 10 days, if necessary, throughout the summer. Currant-worm. See under currant.

Grape.—Anthracnose. 1, Before buds break in spring, sulphate of copper; 2, Bordeaux mixture after 3 or 4 days, to cover untreated portions. Pick and destroy diseased bunches. Burn diseased wood. Black-rot. 1, As soon as first leaves are fully expanded, Bordeaux mixture; 2, After fruit has set, Bordeaux mixture; 3, Repeat 2 at intervals of 2 to 3 weeks until fruit is three-fourths grown; 4, Ammoniacal copper carbonate when fruit is nearly grown. Downy mildew, powdery mildew, the first application recommended under Black-rot is of special importance. Ripe-rot, apply very thoroughly the later applications recommended under Black-rot. Steely-beetle. 1, As buds are swelling a strong poison spray, as Paris green at rate of 1 lb. in 50 gals. water, with 2 lbs. lime; 2, After 10 to 14 days repeat 1; 3, Apply poison spray (1 lb. Paris green to 100 gals.) on foliage in June, to kill the brown grubs. (Very important.) Root-worm. Thorough cultivation in June to kill pupae. Strong poison spray (arsenate of lead, 4 lbs. in 50 gals. water); repeat this application a week or ten days later. Leaf-hopper. Whale oil soap, 1 lb. in 10 gals. water, applied very thoroughly to undersides of leaves about July 1st. Berry-moth. Pick off purple-spotted, green berries in August. Spray with poison just before blossoms open and repeat application just after blossoms drop.

Raspberry, Blackberry, Dewberry.—Anthracnose. 1, Before buds break, copper sulphate solution; also cut out badly infested canes; 2, When growth has commenced, Bordeaux mixture; 3, 4, etc., Repeat 2 at intervals of 1 to 3 weeks, avoid staining fruit by use of clear fungicide. (Partially successful.) Badly infested plantations should be rooted out. Orange-rust or yellows. Remove and destroy affected plants as soon as discovered. Saw-fly. 1, When first leaves have expanded, arsenites; 2, After 2 to 3 weeks, repeat 1 or apply hellebore. Galls, Snowy Tree, Cricket Egg-scars, Girdlers and Borers. Cut out and burn infested canes in spring.

Strawberry.—Leaf-blight, Mildew. 1, When growth begins in spring, Bordeaux mixture; 2, When first fruits are setting, repeat 1; 3, After fruiting, or on non-bearing plants, Bordeaux mixture at intervals of 1 to 3 weeks. White-grubs. No application to soil is effective. Frequent cultivation kills and discourages many. Digging out grubs is only sure method.

Sprays for Orchard.

Apple.—Scab. 1, Bordeaux mixture when leaf buds are open, but not before flower buds expand; 2, Repeat 1 as soon as blossoms have fallen; 3, Bordeaux mixture 10 to 14 days after the third; (4, 5, repeat

3 at intervals of about two weeks). Canker. Cut out badly diseased parts; when spraying for scab, spray trunk and branches. Canker-worm. When caterpillars first appear (in May), apply a poison spray very thoroughly; 2, Repeat 1 after 4 to 10 days; (3, 4, repeat every 10 days if necessary). Thorough cultivation kills many in soil. Sticky bands on trunks will prevent many of the moths from ascending the trees in March to lay eggs. Bud-moth. 1, As soon as leaf tips appear in buds, a poison spray; 2, Repeat 1 before blossom buds open; (3, repeat 2 when blossoms have fallen). Codling-moth. 1, A poison spray immediately after blossoms have fallen; 2, Repeat 1, 7 to 10 days later. Use burlap bands on trunks, killing all insects under them every ten days from July 1st to August 15th, and once later before winter. The poison may be added to the Bordeaux mixture and the two applied together with excellent effect. Case-bearers. As for bud-moth. Apple-maggot. Keep windfalls picked up and destroyed or fed out. San Jose scale. Summer treatment: Kerosene emulsion diluted with 6 to 8 parts water. Late fall and winter treatment: Lime and sulphur wash. Whale oil soap, 2 pounds in 1 gallon water. Crude petroleum diluted to about 25 to 40 per cent of oil, either with an oil-water pump, or better in an emulsion with soap.

Apricot.—(See Peach.)

Cherry.—Black-knot. See plum. Rot. 1, When buds break, Bordeaux mixture; 2, When fruit has set, repeat 1; (3, when fruit is grown, ammoniacal copper carbonate). Aphis. 1, Kerosene emulsion when insects appear; 2, 3, Repeat at intervals of 3 to 4 days if necessary. Curculio. See under plum. Slug. 1, When insects appear, poison spray or hellebore; 2, 3, Repeat 1 in 10 to 14 days if necessary.

Peach, Nectarine, Apricot.—Brown-rot. 1, Before buds swell, copper sulphate solution; (2, before flowers open, Bordeaux mixture); 3, When fruit has set, repeat 2; 4, Repeat after 10 to 14 days; 5, When fruit is nearly grown, ammoniacal copper carbonate. Pick off and destroy diseased fruit in autumn. Curl-leaf. 1, Before buds swell (March or April), use strong Bordeaux mixture. San Jose scale, see apple. Curculio, see plum.

Pear.—Blight. 1, Cut out all affected branches in fall before leaves drop; 2, Repeat 1 whenever necessary during growing season. All branches should be cut 6 to 10 inches below point of infection; burn the parts. Leaf-blight or fruit-spot. 1, Before blossoms open, Bordeaux mixture; 2, After blossoms have fallen repeat 1; 3, 4, etc., Repeat 1 at intervals of 2 to 3 weeks, as appears necessary. Scab. See under apple. Leaf-blister mite. 1, Before buds swell in spring, kerosene emulsion diluted 3 to 5 times. Psylla. 1, When blossoms have fallen in spring, kerosene emulsion diluted 7 to 8 times, or whale oil soap, 1 lb. to 4 or 5 gals. of water; 2, 3, etc., At intervals of 2 to 6 days, repeat 1 until the insects are destroyed. San Jose scale, Codling-moth. See under apple.

Plum.—Brown-rot. See under peach. Leaf-blight. (1, When first leaves have unfolded, Bordeaux mixture); 2, When fruit has set, Bordeaux mixture (dilute for Japanese plums); 3, 4, etc., Repeat 2 at intervals of 2 to 3 weeks, use a clear fungicide after fruit is three-quar-

ters grown. Black-knot. 1, During first warm days of early spring, Bordeaux mixture; 2, Repeat 1 where buds are swelling; 3, During latter part of May, repeat 1; 4, Repeat 1 during middle of June. Cut out and burn knots. Curculio. Some are successful with poison sprays, applying once before blossoming and twice after blossoms fall, at intervals of a week; arsenate of lead poison (2 to 4 lbs. in 50 gals. water), and arsenate of lime have been most effective. Jar the trees after fruit has set, at intervals of 1 to 3 days during 2 to 5 weeks. San Jose scale. See under apple.

Quince.—Leaf-blight or fruit-spot. (1, When blossom buds appear, Bordeaux mixture); 2, When fruit has set, repeat 1; 3, 4, etc.. Repeat 1 at intervals of 2 weeks, until fruit is three-quarters grown; if later treatments are necessary, ammoniacal copper carbonate. Blight. As for pear. Curculio. Jar, as for plum curculio. Poison sprays early in August have given promising results. San Jose scale. See under apple.

Sprays for Forestry.

Elm.—Leaf-beetle. Arsenate of lead spray as soon as leaves are formed; 2, Repeat 1 a month later; kill beetles as they descend tree in August.

Maple.—Tent-caterpillars. Collect and burn egg-rings in fall and winter; offer prizes to children for this. If practicable, spray with a poison soon after first leaves appear. Later cut off and burn the tents with caterpillars enclosed, or jar and brush off the caterpillars as they cluster on the bark and branches or trunk during the day. Tussock-moth caterpillars. Interest the children to collect the conspicuous white egg-masses in fall and winter. Spray trees with poison when caterpillars appear, if practicable. Borers. Difficult to reach. Sometimes can inject carbon bisulphide into burrow and by closing the hole tightly, the fumes may reach and kill the borer.

FORMULAS.

Fungicides.

It is safe and often desirable to use the poison insecticides with Bordeaux mixture.

Soda-Bordeaux.

Soda	2 pounds
Copper sulphate	6 pounds
Lime	½ to ¾ pound
Water	60 gallons

Commercial soda lye may be used, but the mixture must be tested to insure its alkalinity. The amount of lime may in some cases be slightly diminished according to strength of the lye.

Dissolve and dilute the lye to 10 or 15 gals. and pour into the copper solution and then add lime as required. Paris green may be safely used in connection with this mixture.

Ammoniacal Copper Carbonate.

Copper carbonate	5 ounces
Ammonia (26 degrees Beaume)	3 pints
Water	45 gallons

Make a paste of the copper carbonate with a little water. Dilute the ammonia with 7 or 8 volumes of water. Add the paste to the diluted ammonia and stir until dissolved. Add enough water to make 45 gallons. Allow it to settle and use only the clear blue liquid. This mixture loses strength on standing.

Copper Sulphate Solution.

Copper sulphate ..... 1 pound
Water .....15-25 gallons

Dissolve the copper sulphate in the water. This should never be applied to foliage, but must be used before the buds break. For peaches and nectarines, use 25 gallons of water.

Potassium Sulphide Solution.

Potassium sulphide (liver of sulphur....½-1 ounce
Water ..... 1 gallon

This preparation loses its strength upon standing, and should, therefore, be made immediately before using. Particularly valuable for surface mildews.

Insecticides.

Paris Green.

Paris green ..... 1 pound
Water .....50-150 gallons

If this mixture is not to be used in Bordeaux mixture, 2 lbs. of quick-lime should be added to prevent burning foliage. It is sometimes used as strong as 1 lb. to 50 gals. on potatoes, but usually at the rate of 1 lb. to 100 gals. on most fruit trees, except peach and plum, where the weaker mixture of 1 lb. in 150 or even 200 gals, is safer. For insects that chew.

White Arsenic.

White arsenic being cheaper and of more constant strength than Paris green, is becoming increasingly popular as an insecticide. It may be safely used with Bordeaux mixture, or separately, if directions as to its preparation are carefully followed; if, however, these are neglected injury to the foliage will result. The following methods of preparation will be found satisfactory. It is unsafe to use white arsenic with soda or lime.

I. Arsenite of Soda for Bordeaux Mixture.—To a solution of 4 lbs. salsoda crystals in 1 gal. of water, add 1 lb. of white arsenic and boil until dissolved. Add water to replace any boiled away, so that 1 gal of stock solution of arsenite of soda is the result. Use 1 pint of this stock solution to 50 gals. of Bordeaux on apple and pear trees, but twice as strong on potatoes, and only half as much on peach or plum.

II. Arsenite of Lime.—(a) If used alone (not in connection with Bordeaux), white arsenic should be prepared thus: To a solution of 1 lb. of salsoda crystals in a gallon of water add 1 lb. of white arsenic and boil until dissolved. Then add 2 lbs. of fresh slaked lime and boil twenty minutes. Add water to make 2 gals. of stock solution. Use 1 quart of this stock solution to 50 gals. of water.

(b) Boil 1 lb. of white arsenic in 2 gals. of water for an hour or more and use the solution while hot to slake 2 lbs. of good, fresh

quick-lime. Add water to make 2 gals. of stock solution and use 1 quart of this to 50 gals. of water or Bordeaux mixture.

Other Poisons.

Green arsenoid and Paragrene are more bulky and finer than Paris green, and when of good quality they are just as effective and require less agitation.

Arsenate of lead or "Disparene" can be applied in large quantities without injury to the foliage; hence it is very useful against beetles and similar insects that are hard to poison. It also adheres to the foliage a long time. Use in strengths varying from 1 to 4 lbs. to 50 gals. of water. Ready for use as soon as paste is stirred in the water.

CHAPTER XXI

The Woman on the Farm

The Mission of the Farmer's Wife.

AS this book goes to press, the Second International Congress of Farm Women is in session at Lethbridge, Alberta, Canada. The first of these congresses, held October 17-20, 1911, at Colorado Springs, Colo., was the outgrowth of the zeal and far-sightedness of a few women who met in the summer of 1911 and planned this first meeting of a movement to better the social and economic state of farmers' wives and farm women all over the world. The organization, which was the result of that meeting, adopted a constitution which declared that the Congress should be an auxiliary of the International Dry-Farming Congress. Its aims should be, quoting from the constitution:

"To enforce the conditions, financial, physical, social and spiritual, of agricultural homes; to understand more completely the significance of the farm to the life of the nation and the dignity of the position of the farm woman as co-worker in the most potential and far-reaching of the national industries; to increase conservation of energy through social intercourse, and by observation of processes; to develop the home to a greater understanding of modern appliances and education in scientific management of work; to further develop the home through conference with authoritative experts on dairy methods, poultry culture, kitchen gardening, improved methods of equipping the home, problems of nutrition, children's welfare, industrial education, including home economics, the increase and proper use of leisure and the stimulation of social intercourse in rural communities, and to stand for a more generous state and national support and encouragement of institute and extension work among farm women."

In the year that has passed since that Congress, and the organization of farm women that resulted from it, the auxiliary has been developing strength of numbers and much effective gain in the increase of such rural bodies as women's granges and branches of farmers' institutes. These farm societies have helped farm women to use their working hours to better advantage from the point of strength and health, to get better results from their increasing labors, to lessen their hours of work, and yet to improve their home and educate their children with greater efficiency. Farm life has been made less of a drudgery. Farm homes are more cheerful.

Will Educate the Children.

The Congress has not only helped to bring about these improved conditions of home labor to some extent, but it has inspired a spirit for better social and educational opportunities for the farm children. It

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will do more than that in time. It will give those children a vision of progress that will end in a goal. Not alone of more farm profits, but in a better world for the landless and the homeless of our cities. The farmer's child has his place in the struggle for a living made for him from the start. He is listed among the producers of the world. Educate him so thoroughly, say the women of this Congress, that he will not further widen the line between him and the unproductive tramp of the harvest field—will not think that his knowledge of him ends by "giving him a cold potato and letting him go."

Mrs. Burns' Outline.

Mrs. Eleanor L. Burns, the secretary of the new movement, outlined still more clearly and fully the objects of the Congress in a recent contribution to the Lethbridge Herald. She said there:

"Our aim is to understand more completely the significance of the farm to the life of the nations and the dignity of the position of the farm woman as co-worker in the most potential and far-reaching of the national industries; to increase conservation of energy through intercourse and observation of processes; understanding of the modern appliances and education in scientific management of work; to further develop the home through conference with authoritative experts on dairy methods, poultry culture, kitchen gardening, improved methods of equipping the home, problems of nutrition, children's welfare, industrial education, including home economics, the increase and proper use of leisure and the stimulation of social intercourse in rural communities. This organization stands also for a more generous state and national support and encouragement of institute and extension work among farm women."

A Practical Farmer's Wife.

It is true that the agricultural schools and colleges of the country are every year increasing the scientific knowledge of farm life as a vocation for young women. But scientific knowledge is not always practical knowledge. Home making is also the special function of women, but a woman cannot make a home alone. The farmer must see to it first that however the farm returns are spent a certain portion of them goes to making the farm home more comfortable, convenient and labor-saving for the wife and children. He may not always have much cash for this purpose, especially if he is a young man just married, but the two things that every true man has—a strong arm and a kindly heart—can be put to their best service only by a consideration, first for the family side of farm living; and second, an eye to the beauty of farm surroundings. An attractive home is no more expensive than an unattractive one. A labor-saving house is less costly than an inconvenient and illy-planned house; for time, on the farm, is truly money.

The first mission of the young farmer's wife, therefore, is to take the lead in all movements to make real farming attractive. By real farming, I mean such farming as the average farmer must cope with—the farming where income and outgo must be carefully watched,

where the land is about the only capital, and where some debt usually rests on the property. On such a farm every new piece of machinery must pay for itself, and the kind of close management demanded has very little relation to the agriculture carried on by wealthy land owners with whom farming is only one of a dozen different interests. It is upon the countless little farms of forty, sixty or perhaps a hundred and twenty acres that are beginning to show themselves all over the country that this new farming movement for women will grow to the best results.

Danish Law As to Loans.

It would be a far-sighted plan for every state if the Danish law as to loans for small farmers were adopted, with some modifications. The law there says that every man, or unmarried woman, whose chief occupation is farm work, and who otherwise is able to comply with the requirements of the law, may obtain a loan from the state to the extent of nine-tenths of the (loan) value of the property, which must not exceed $2,144 (horses, cattle and implements included).

Interest is paid at the rate of 3 per cent annually, but no repayment of the principal during the first five years, after which period 4 per cent per annum constitutes interest and extinction of the debt.

Observe Economy.

The expectant farmer's wife, therefore, should plan her home with a view to economy, first. Let it be true economy, however. As between a large kitchen, with poor lighting and ventilation, and a small one, with plenty of windows to the east or southeast, and a perfect ventilating system, choose the small kitchen, with a distance between the kitchen table and the cooking range of not more than six feet. Put the sink and its attachments as near the table as possible, and near, or under a window. In fact, if the whole eastern side of the kitchen can be given up to windows, sufficiently high from the floor to permit of the kitchen conveniences being arranged under the windows, it will be a most desirable plan.

In fitting screens on these windows, have them full length, thus insuring the lowering of the window at the top in the summer time. A ceiling ten feet high in a kitchen is not too high. As to floors, opinion is about equally divided between the hardwood floor, finished in oil or painted, and a floor covering of linoleum. The linoleum is a saver of labor, there is no doubt, but must be renewed oftener.

In figuring any expenses and income on the farm the women of the farm must see to it that their own labor is counted at its full worth. In fact, in all farm transactions of which a capable woman has charge, she must reckon in as outgo not only her labor, but the interest on the investment, the repairs of equipment, cost of food production, deterioration of whatever live stock she may be managing, and then add a department for "sundries," that mysterious agency that flies away with so much of our estimated profits in any work.

Have a Soil Survey.

A woman can also, before going upon a farm, learn by a soil survey of such portions of the land as she plans to use for vegetable and

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fruit gardens what is the fertility basis upon which she is to begin her labors. If that special spot is poor in soil value, but has good drainage and a pleasing outlook, keep it for the surrounding value it gives to the home site. The fertility of almost any soil can be rapidly built up by proper agriculture. But you can't change the configuration of land or the process of the sun by any sort of soil maneuvering. A sunny slope, a few trees, a beautiful view, are worth more at first to the future home builders of the farm life than the precise balancing of nitrogen phosphorous and potash in the garden soil. To decide such points is essentially the woman's part in the new life, whether she be a pioneer in an isolated homestead, or a suburban small-truck worker.

Sanitary Surroundings.

Another feature of farm life in which the farmer's wife has every right to concern herself is as to the location and arrangement of the outbuildings with relation to the house and its surroundings. As a general thing the farmer will wish to put all of the barn surroundings too near the dwelling for beauty or sanitation. It would be only natural for him to want to save time and steps for himself and his farm help. But on this point the woman of the farm must take a decided stand. And if she uses her influence wisely and with tact the most "sot in his ways" man will be reasonable enough at last to yield the point of his own small economies to the larger ones of the comfort, pleasure and health of his family. The farm buildings should not be nearer to the house than the length of a city block, or about 500 feet. This distance prevents the bringing of much objectionable farm litter into the house, and does away with nearly every chance of those unpleasant odors which even the best kept barnyards sometimes send out. Such a distance also permits of landscape work around the house as time goes on, and enables the wife to plan screens of vegetation growing about flower beds that will shut out unsightly spots.

Labor-Saving Methods.

A woman, also, well trained as to the sanitation of farm life, would also see to it that the water supply, if it must be from a well, was drawn from one with proper surface and subsoil drainage and properly protected surroundings as to germ contagion. The very isolation of so many of our farms would give her a deeper sense of her responsibility for the health of the family. She would be the only health officer of her own district, and should be all the more self-reproachful if an infectious disease broke out in it. And as soon as the farm finances would permit, she would see to it that some form of water supply other than the well was installed in her home.

On this point, I shall include here an account of the farm of a dairyman at Poynette, Wisconsin, which possesses one of the smallest farm plants for electricity in the country. "The Electric News Service" is responsible for the following account of this:

"This tiny plant supplies current for twenty-four lamps and is operated entirely by the farm windmill at a total of a few cents a year for lubricating oil.

"The farm consists of about a hundred acres and is devoted to stock raising and dairying. The power windmill is twelve feet in diameter with a vertical shaft extending down the tower; attached to it are the power pulleys, etc. In addition to driving the electric light dynamo this mill is used to operate a drill press, grindstone, corn sheller, small saw, washing machine, grain elevator and feed grinder.

"The dynamo is located in a small building at the base of the windmill tower. This dynamo has a capacity of six amperes at thirty-five volts, or 0.21 kilowatts when driven at full speed of 450 revolutions a minute.

"The variations in speed, due to irregularities in the wind, are overcome by a small automatic switch placed in the circuit between the generator and the storage batteries, which prevents any accidents to the apparatus by 'breaking' the circuit when a certain range of speed has been passed.

"This tiny plant illuminates the home, the yards and the barn buildings. All the lamps receive their current from the storage battery, the charging of which is the dynamo's only function."

As will be seen, the plant is only used for lighting at present; but an extension of the same power could easily be made to cover heating and a water supply by using a gasoline engine for an emergency additional service. With regard to the latter, one farm authority claimed recently that, with a gasoline engine, "the farm home can be fitted with hot water heat, hot and cold water, bath and toilet room, electric lights, wash room in the cellar, etc., for $1,000. The interest on $1,000 is $60 a year. Ten per cent for depreciation and repairs is $100 a year. The saving in coal will pay for the cost of running the lighting and water systems. For $160 a year the farm home can be provided with every modern convenience that the city home possesses.

"By using a furnace and an acetylene system the annual cost can be lowered to about $85. The city man pays that extra $7 to $14 a month and more in increased rent and thinks nothing of it."

Now I shall add to this estimate a list of labor-saving devices in the farm home which was given by Mrs. John A. Widtsoe, of Logan, Utah, at her very practical address last year before the Congress of Farm Women. Her list does not include any fixtures or machinery run by electric power. Therefore the question of running expenses does not come in, as a public utility, as in the case of villages. As will be seen, Mrs. Widtsoe's list is very comprehensive as a time-saver:

Heating system	$400.00
Complete water system, including bath tub, sink and pressure tank	125.00
Sewing machine, say	50.00
Refrigerator	50.00
Cement walks, average sized cottage	25.00
Dishwasher	25.00
Fireless cooker	15.00
Washing machine	10.00
Coal oil stove	10.00

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Steam cooker	8.00
Vacuum cleaner, hand	8.00
Cold mangle	6.00
Alcohol iron	5.00
Bread mixer	3.00
Cake mixer	1.00
Total	$741.00

As Mrs. Widtsoe says, if farm women would use their wits to invent other labor-saving helps, or their influence for legislation to promote research into farm home economics and energy savers for the farmer's family, it would be as valuable at least as appropriations for experiments in better breeds of chickens and hogs.

Recreation.

Another duty of the lady of the farm house comes in the necessity for insisting upon recreation. On this point I shall quote from some advice given by a farmer to other farmers in an Eastern agricultural paper. The writer says:

"Most farmers think it impossible for them to leave the farm for even a day or two during the summer. They have the impression that the farm can't get along without them or that they do not need recreation. It is quite important that both the mind and body have a rest occasionally. Even though every day is a seemingly busy one for the farmer there is no excuse for his sticking about the old place continually grinding away his life. Take a few days off now and then. Go fishing, go visiting, go sightseeing, go somewhere to get away from the same old scenes. You will live longer, be happier and die just as rich as though you never spent any time in recreation. Don't forget there are other members in your family who need an outing occasionally as well as yourself, and take them along with you."

Don't forget this, farmers' wives! Have it printed in large type, and hang it up in the kitchen. Your "man" will take the hint by slow degrees. If he doesn't, try stronger arguments. You know how to use them, when necessary. Otherwise what were tongues given to women for?

The Most Valuable Crop.

And now, as a last suggestion to the farm woman, let me mention that the thinking crops on the farm are very little cultivated by the women of the farm. As a rule, she leaves too much of the agricultural planning, the question of permanent improvements and of systematic increase of farm values to her husband. Granted that the home has been planned and built, the grounds laid out and the farm buildings located as she has suggested and under her careful eye; granted, too, that she has taken for her own labor and rewards certain departments of farm life, and carries them on with efficient energy, does her share in the work stop there? Not at all. She must continue to think for the whole body of the farm life—not for one member of it.

In any other vocation of life than farming, there are many reasons why women cannot, and perhaps ought not, to expect to help actively

in the management of their husband's affairs. Professional men are entrusted with too many secrets. Merchants have hosts of important side issues of which the strings can be handled only from the office desk. Manufacturers are constantly tossed up and down on the waves of good or bad times, and are often the victims instead of the sharers in prosperity unless they know how to keep their own counsel and paddle their own canoes. In all these affairs the working forces are more or less hidden from the view of women and it could not well be otherwise.

With the occupancy and cultivation of land, though, the woman sees everything spread out before her feet and at her fingers' ends. She knows good and bad harvests, as well as she knows good and bad farming. Her comparisons for use often lie in the next farmstead. She may not draw too obvious a moral from those comparisons, for that would not be good policy. But if she has any mind at all of her own, that mind is sitting in silent judgment on the methods of the farmer. Why not put it to some better use than mere reflection or dissatisfied comparison?

Would it do any harm for the wife to suggest to the farmer that his farm might show better profits if he ran his poultry, hog, fruit, or stock crops as separate departments, to be managed by different members of his family? Two heads are better than one. Why not a half dozen independent departments on a farm, each responsible to the farm owner only for a certain profit? Beyond that line, let the gains belong to the independent worker, and let them be allowed to push their own work to any pitch of business success by fair methods.

Why not keep a diary of farm happenings, farmer's wife? You will find it of the greatest help later on. Keep also a book in which all clippings of value as to the farm are transferred. It isn't necessary to speak about the possession of this book. But once in a while make a timely suggestion as to things which can be done next winter, when the work is slack around the farm. Keep your eye out for necessary repairs on outbuildings. Get together in your own home, in the long winter evenings, little groups of the neighbors. If you don't begin with more than two or three, but judiciously select those few, you will be surprised at the new jolt given to the farming ideas of the man of the house. And probably your little social venture may grow into a general agricultural society for your whole section as soon as the other farmer's wives have caught on to the idea.

What social movement of our day could keep pace with the benefit to the whole world of a rural awakening on the subject of soil betterment and social uplift for the farm? Not in the city, but in the country—the large, quiet places of the earth—is the battle ground where the salvation of the laborer is to be worked out. What a part for a woman to play! Have our farmers' wives and daughters the skill, the self-sacrifice, the energy, and the indomitable persistence to play it to the well wrought end? The coming generation can best tell how the thought crop will yield on the farms of the next thirty years. It must yield abundantly if we are to remain the United States.

Women farmers, be proud of your profession, and show your re-

Mrs. Eleanor L. Burns

Secretary of The Second International Congress
of Farm Women

spect for it by demanding in a womanly manner the consideration such a feminine power in the world deserves. Don't be too long-suffering nor patient. Don't be too exacting. Only ask for what you ought to have as the conserver and developer of the most potent factor in civilization, the farm home. You will get it if you only work long enough and hard enough.

CHAPTER XXI

Early Day Farming in the East

AFTER the close of the Revolutionary War and the War of 1812, a great number of young persons emigrated from Massachusetts and Connecticut, to Western New York, and to Pennsylvania. They found that the land in these then western states was thickly covered with forests. So the first work they did was to build log huts on their claims. They called a "bee" to do this work, helping each other in that way, until each family had a home. Most of these emigrants brought with them a yoke of oxen. The father of the writer brought with him a good ox team, a wagon and all kinds of farming implements that were made in those early days.

The houses were quickly built; then the next work was to clear the land, removing from it the mighty forests. Ninety-nine per cent of the people spent most of their best days in clearing from the land tall white pine trees and white oaks. Hundreds of these tall pines and large oaks stood on an acre of ground and were often found to be from 3 to 4 feet, and some of them even 6 feet in diameter.

In those early days some of those tall white pine trees were sold from 25 cents to $1.00 per tree to shingle makers. Thousands of these great, gigantic trees were cut down and hauled from one log heap to another with the poor ox team until the logs, and oxen also, were nearly worn out. Weeks and months were spent in clearing these lands before any crops could be raised on them. When the irksome task was completed, they found the soil very rich, and on it they could easily raise all kinds of grains and garden vegetables.

The writer was personally acquainted with some of those early settlers that still reserve these forests. The late Jacob Roads of Tompkins Co., New York, could point out at the time of the Civil War tall, white pine trees in his forests that he was offered $100 per tree for, just as they stood. This great forest of white pine and oak trees was situated five miles east of Ithaca, N. Y. The late Hon. Elijah Brown and the late William Green of Cayuga Co., New York, owned a very large area of natural forestry containing the white pines and oaks and also a large number of hard maple trees.

Farming Methods.

Nature had supplied these new lands with a large quantity of soil fertilizer. Commercial fertilizer was unknown to the early settlers, but the first years these lands produced large crops without them. The surface soil was a deep, rich, dark and sandy loam with a small percent of gravel mixture. The depth of this surface soil was from two to three feet, and the hardpan sub-soil was a deep yellow clay substance from four to six feet in depth and so compact and con-

centrated that water could hardly penetrate it. This being so concentrated, it became a great reservoir for supplying moisture to the surface soil and made it proof against drouth.

Crop rotation was practiced in those early days. The lands that were sown in the autumn with winter wheat, were sown again about the first of March or in early spring with clover, mixed with grass seeds. This mixture was from eight to twelve quarts per acre. The red clover when green, and in full bloom, was plowed under and refertilized, the soil supplying to it the needed elements, such as humus, phosphorous, etc. This clover, a mammoth red English, was very well known and highly valued for its large yield of crop, and was even then the best known fertilizer for exhausted lands. In those days the crop rotation was sod ground for corn and potatoes the first year, the second year barley and oats were sown, next the winter wheat. In the early spring, it was sown to clover and sometimes the clover was cut for hay or, when necessary, plowed under to fertilize the soil.

Habits and Diet.

The farmers of the early days were very early risers. They were up about 4 o'clock in the morning, the year around. They believed in that old adage, "Early to bed; early to rise makes a man healthy, wealthy and wise." Most of them attained a very old age. Their average age was from 75 to 100 years. Their good health probably resulted from their simple eating and drinking and living. The drinking water was excellent; usually pure cold water from a deep flowing spring which was never known to freeze, even in zero weather. The food was plain, consisting of salt pork, corned beef and all kinds of vegetables raised on the farm. The usual dessert was a pudding made from cornmeal, flavored with a tart dried fruit, such as dried apples, raspberries or cherries. The boiled dinner was a great favorite, made with meats and all kinds of vegetables boiled together in large quantities, as it was often served for supper with warm corn bread, cold rye, or Indian bread. Later in the evening a dish of nice apples with a variety of nuts, such as chestnuts, butter nuts, walnuts and hickory nuts, and a glass of good sweet apple cider, were served.

The morning breakfast consisted of home cured smoked ham and fried eggs, with buckwheat cakes, fresh dairy butter, and the pure maple syrup made from the trees of these forests. Their drink at meal time consisted of milk, barley or crust coffee, or pure apple cider. Often honey was served for supper with warm cream biscuits.

The settlers found apple trees in their forests bearing apples. They grew from the sprouts of trees that the Indians planted in a very early day. When General Sullivan fought the Indians, he had their apple trees cut down and destroyed everything in his march that would provide the Indians with food. Fruit trees were chopped down, and food plants pulled up and thrown into deep waters. He was afraid the Indians would take his several thousand cavalry horses

so he ordered them shot at Horse Head Bay, a place near Elmira, N. Y.

Salt springs were not discovered by the early settlers, but the salt was brought to them by the native Indians (or red men, as they were sometimes called). They brought it in their kettles, and sometimes the salt would be very warm, so the settlers therefore thought the salt springs were quite near to them. But the red man was too wise and cunning to tell them. They hunted far and near, but the Indians had so concealed them that their search was all in vain. Consequently the natives owned the springs, and they furnished salt to the early settlers of my neighborhood at Ithaca as well as throughout the entire country.

Gristmills in a new country were not very numerous and often located from 20 to 30 miles apart. The early settlers met with many difficulties in getting their grist to the mills, but they had to have bread, the "staff of life." They traveled over rough roads with a sack of corn or wheat on horseback, sometimes crossing streams with rafts or wading through when the water was shallow, carrying the sack of grain on their backs, and returning in the same way with the flour for bread.

The early settlers dressed their own meats. To dress the fat hogs they cut down a large tree, and took a log out of it. They dug this log out with an ax, shaping it into a trough which they filled with water and heated by heating stones redhot and dropping them in the water in the trough. If they did not succeed in getting it hot enough the first time they would repeat the process, and this would usually bring the water to a boiling point. The hog was then scalded and dressed very quickly. It was somewhat of a novel way, but proved to be a great success.

Some of the Successful Farmers.

Some of the most successful farmers of the early days in New York were the late Hon. Elias W. Cady of the town of Dryden, Tompkins county, and the late Hon. Benjamin E. Wood of the same town and county. These two men owned large farms that were among the very best in the state. Mr. Cady's farm contained 900 acres of land, 200 acres of this being timber land. They raised mixed crops in rotation on the cleared land, grass and clover mixed for hay land and pasture lands. At the time of the Civil War Mr. Cady had on his farm from 300 to 500 of the very best high bred sheep, from 20 to 30 head of high bred short horn cattle, 15 to 20 head of horses, and 20 to 25 hogs. He raised yearly 20,000 bushels of grain. Wheat, oats, barley, corn, buckwheat; a lot of potatoes and a large amount of mangel-wurzels. These last he fed to his stock. He also cut from 100 to 150 tons of hay yearly.

Mr. Cady was one of the first to raise large crops of clover for pasture and hay. He considered the clover the farmers' bank as a soil fertilizer, apart from its excellent feeding qualities for all kinds of farm stock. The barnyard manure also was looked after very closely and used for fertilizing. Mr. Cady built a number of large barns,

with full basements underneath, always locating on a dry mound or knoll. They were 10 feet deep and were built of stone wall on three sides, the south side being built of wood. This contained a large number of glass windows, so as to let in plenty of sunshine, and doors for the stock to pass through into the stables. All the stock was always housed in warm barns. He also built a number of hay and sheep barns combined. All crops as soon as they were harvested, were put under cover, and also all the farming tools and machinery. When coming to that country he brought with him a thoroughbred valuable mare for breeding, with pedigree back to that imported sire called Messenger, who was brought from England in 1788. Mr. Cady was a great lover of horses, and could say, as did the late Dr. De Witt Talmadge of Brooklyn, N. Y., "I believe there ought to be a heaven for this noble animal, the horse." He always purchased pure bred sires for breeding and he believed in improving all kinds of farm stock.

In the early days, before the time of railroads, they hauled their wheat by team to Albany and brought back a load of groceries or merchandise. It took from 12 to 14 days to make this trip, a distance of 190 miles. At one time before making one of these trips, Mr. Cady found that his wagonbox had to be repaired. He went to a little country store at a small village, told the keeper he had to go to Albany, and would like a few nails to fix his wagonbox, and promised to pay him when he returned; to all of which the keeper replied, "Many persons have asked to be trusted, and have never paid." Mr. Cady left the store. He went back home, got his gimlet from his tool box, bored holes and made wooden pins to repair the wagonbox. He put on a load of wheat and started again for Albany. He met with some difficulties, the country being rough, with many hills, and valleys to encounter, especially one very steep hill, with a stream of water below in the gulley. This hill was 30 rods long, and rose gradually to 150 feet in height, so it was very steep. He partly unloaded the bags at the foot of the hill, drove to the top of the hill, tied his horses to a tree and hauled the bags up the hill himself, then loaded and journeyed on his way.

Mr. Cady always hired his help by the year, keeping two women for the housework, and always two men the year round besides several day men during the busy seasons. He was kind to his hired help, and they stayed a number of years at a time in his service.

His Farm Machinery.

The early settlers did not possess much machinery. Mr. Cady borrowed what he called a stump machine to dig the stumps from the land. It cost him from $25.00 to $50.00 per acre to do this clearing. The stumps were often used to build fences with.

His first mowing machine was a one drive wheel machine. It required a strong team of horses to draw it, the grass being thick and heavy. The knives had to be kept very sharp, and the horses walked very fast to keep up the motion. Therefore they had to rest quite often. The old farmers called this machine "the horse killer."

His next machine was a mower and reaper combined, and about two or three years previous to his death he purchased a self binder. It was about this time that Mr. Cady narrated to the writer this early history and his experiences in New York state. He said he was a poor boy and had to earn his own money by hard work. He traveled by team and found the roads almost impassable. They were cut through thick forests, there were no bridges, so streams had to be forded. Occasionally you would run across a squatter's log hut that had always a cross dog, or two of them, who would run after the passers-by like savage lions, which was not a very pleasant experience to say the least.

The hotels, or stopping places, along the road to the market cities of those days were named "road houses," "half way houses," "center houses," or also called by the name of the first settlers. The fat cattle and sheep were bought by drovers, and driven over land several hundred miles to Boston, New York and Philadelphia. Often when feed was scarce, they utilized all the straw. Frequently new hay was not to be bought for love or money. Sometimes they even had to empty the straw from the bed-ticking to feed the "bossy cow." Afterwards the straw was used for bedding at the barns.

The Thanksgiving turkey was a great favorite among the early settlers, and its flesh was highly valued for food. This great bird of the pioneers was a native of America and was hunted in early days by the Indians. These birds were sold to drovers, who clipped one wing so they could not fly and then drove them in the fall hundreds of miles to Boston, New York and Philadelphia in readiness for the Thanksgiving and Christmas festivities.

Most of the early settlers lived and died on their first purchased homes or farms. They erected beautiful frame houses, with large fireplaces and big open chimneys. These houses had the best of ventilation systems. They loved their homes very dearly, and were fond of sitting before the fireplaces winter evenings with their loved ones gathered about them, softly singing "Home, Home, Sweet, Sweet, Home, There Is No Place Like Home."

Mr. Cady accumulated a large fortune. He made large donations to help build the first railroad that came through his home town, Dryden. He also purchased a farm for each of his sons and started them out in life.

Mr. Cady lived a noble life, was very generous, always helping the poor and needy and helpless about him. Thus an honorable and useful earthly career was ended at a ripe old age of 97 years.

Squatters.

In early days, squatters of New York lands would settle on non-residence lands, and were held for taxes. The laws were very strict. A tax-collector, when put into office, was sworn under oath not to return the land to the controller of these non-residence lands at Albany until all the personal property of these squatters had been attached and sold at auction-sale. Sometimes the only cow they had was sold, even the cooking utensils, and in some cases everything in

doors, and out of doors as well, had to go, oftentimes just for a few cents or shillings.

Sometimes they did not get enough from this sale to pay the taxes. In that case the land was returned to the controller at Albany and the money collected received. Occasionally the tax-collector would, at his own expense, return the articles sold to the poor squatter, and he would remain on the land just the same. Yet the squatters feared the tax-collector even more than the wild beast of the forests. They knew that the beast would only take his fill, while the tax-collector would take all and then was not satisfied.

Making Maple Syrup and Sugar.

This the settlers did in early spring by tapping the maple trees. To catch the sap they made troughs by cutting down some of the best basswood trees and removed the bark. A tree two or three feet in diameter was cut into logs about three feet long, and these logs were split in halves and made into sap troughs by being dug out and then charred or burned. This was done very carefully, so as not to injure the troughs, after which they were scraped, carefully washed, and placed under the tapped trees to catch the sap. The sap that flowed was put in a boiling kettle (when not in use for boiling the dinner) and boiled down into syrup or sugar. Being the pure stuff it had a fine flavor.

Before the day of apple cider vinegar, sap of the soft maple and of the birch tree was boiled down and converted into vinegar, the early settlers thus making their own vinegar. In the fall of the year, when the grain was hauled a long distance to the cash markets, they purchased in bulk their yearly supplies of groceries, etc., for family use. In those early days, where it could be done, dams were built across large streams of water to form a waterpower and grist mills were erected, but were very far apart. Sometimes flour was scarce, and corn was used for food prepared in different ways.

Laying in Stores for the Future.

The old saying is "save for a rainy day"; it may also be well to lay up something for a dry day. The farmer is never sure of a crop. Often it is taken by hot winds, hail, or drouth, and failure comes in many other ways. The writer has known a number of farmers who laid aside large quantities of produce when it was plentiful, built large barns and storehouses and stored thousands of bushels of grain for a period of years. I knew three brothers who stored in large barns thousands of tons of the sweet, odorous hay for 30 years and more. Also large stacks were built and were covered over with good boards, board roofs and trimmed at the bottom in barrel-shape so that mice could not destroy the hay. And in time, as in Egypt of old, a great scarcity came from drouth. Crops failed and these men sold the wheat for $4.00 per bushel and the hay for $30.00 per ton, and the famine was so great that people were glad to get it at any price, coming for it for many miles as did the people in olden times when a great famine swept over the land of Egypt.

People are being warned in this twentieth century of crises in the near future in the United States. The Rev. Ira R. Hicks says, "The next Jupiter period will be centrallated in 1912, hence we are to expect all the peculiarities of a Jupiter disturbance during 1911, 1912 and 1913." He says that "during this period a maximum of general rainfall will be reached and at least one season of the three will bring a crisis of drouth to all the extremes of our own and other continents. It is believed that the crisis will come over the great grain-producing sections of this country during the summer and autumn of 1912 and 1913. The warning is that during one season of the three years we may look for a widespread drouth."

This is not a dream as was King Pharoah's dream. Yet Dr. Hicks seldom fails in his prophecies. Therefore farmers, agriculturists and commercialists in general should take warning, as did the people of old at the time of the great famine in Egypt. Plant such crops, and make such plans as will be to your interests, laying aside as much as can be done for the future drouth. Do these things in a wise, timely, resolute way, and you will find to your infinite surprise and delight that the severest drouth may be passed without such a great loss as losing homes and starving for want of food. Let us be wise and take the warning. Lay up stores and be prepared for the crisis, if it should come to this noble country of ours.

Wild Fruit and Game.

When the red man was king of the forests of Southern and Western New York he camped near the large lakes such as Genesee, Cayuga and several others. Some of these lakes were from 300 to 500 feet deep, and about 40 miles in length. These lakes were the breeding places for wild game, such as geese, ducks, etc. The writer's father saw acres of the lake waters covered with these birds. Also the choicest kind of fish abounded there; the speckled trout, pickerel, and salmon, and other varieties as well.

The natural forests contained a goodly supply of wild fruits, nuts, etc., such as chestnuts, hickory nuts, black walnuts and butternuts. The many species of the oak tree were very productive of acorns, etc., thus supplying the wild game with their winter food. Winters were mild, with only a light snowfall in mid-winter, which was usually over soon and in a few hours the sun shone again, bright and warm. Deer came out of the forest and were very plentiful. The forests were rich with wild fruit; delicious grapes in great quantities, and wild plum trees that grew from 20 to 30 feet in height and bore excellent fruit of different flavors.

Two Great Inventors.

Professor Morse, who invented the telegraph, and the late Hon. Ezra Cornell, of Ithaca, New York, met each other the first time at Washington, D. C., and became great friends at once. Professor Morse was there seeking for a patent on his great invention, while Mr. Cornell was trying to get a patent on a plow which he had invented.

During their stay at Washington Morse and Cornell united their

forces and thus succeeded in building the first telegraph line in the United States, between New York City and the city of Philadelphia.

Professor Morse's first idea was to dig a trench (making use of Cornell's plow), placing the telegraph line in this trench, under ground; but, from the line not being encased properly, after giving this plan a fair trial, it proved to be an entire failure. Then Cornell said to Morse, "If you can make it a success I want you to go ahead with it."

Mr. Cornell then invented the glass insulators and placed the line above ground on poles, and this method worked so well that the telegraph became the great success it has been ever since for the whole world.

The late Hon. Ezra Cornell was well and very favorably known in Ithaca, New York. He was for two terms a member of the legislature of the State. His son, Hon. Alonzo B. Cornell, was at one time governor of the state. Ezra Cornell was, like Lincoln and the late Governor Johnson, of Minnesota, a self-made man, born a poor boy, and worked his way upward without any financial aid or means, except his own earnings.

He was the founder of Cornell University. His first gift to this great University being $500,000 and 200 acres of land. His wish was to found an institution where any person could find instruction in any study. It has become one of the strongest and most flourishing universities in the United States. Much more land has been added to the campus and every nation on the globe has had its representatives in this great university, which now has about 7,000 students or more in attendance each year.

Ezra Cornell was also a great benefactor to the American farmers. He was a large farmer, always doing his farm work in a systematic way and proved to be very successful. It was after his acquaintance with Morse that he became the owner of large tracts of very valuable land near Ithaca, and on part of this land Cornell University now stands. A whole-souled man he was, also a liberal one, ever remembering the poor and needy.

Mr. Cornell was an importer of thoroughbred short-horned cattle, and pure bred sheep, and also a great breeder of fine horses. After his death, the administrator, Frank E. Cornell, sold the entire herd of pure bred Duchess short-horned cattle, about sixty in number, to a Minnesota man, who was a breeder of short-horn cattle. It was a great advantage to the state of Minnesota to be able to secure so fine a herd of pure bred short-horn cattle.

Thus the late Ezra Cornell blessed the world in many ways, and may his life ever live in the hearts and lives of those whom he came in contact with.

The American Farmer of the 20th Century.

George Washington well said, "Agriculture is the most useful and the most noble employment of man." The American farmer is the controlling element in our civilization. He makes secure the present and holds the destiny of the future. "The nation that feeds the

world, rules the world." Then high, indeed, is the place of this nation and in the highest place stands the American farmer.

The modern farmer of this century is receiving the benefit of the concentrated wisdom and talent of a great mass of labor of scientific men that spent thousands of their hard earned money, as well as many years, to invent all kinds of farm machinery. These inventions proved a great success and in most cases moved as perfectly as a time clock. American farming machinery is much better than that of foreign nations. The inventions are lighter in weight and better in all respects. The life of the farmer has often been called a life of drudgery, but this is not so at the present day. Take, for instance, the plow. First it was the wooden beam plow, then the sulky plow, and now it is the steam plow which is in use on our western prairies, turning five furrows at the same time. The united talents of great inventors have made farm labor more easy. The farmer can ride on these farm implements behind his noble steeds and therefore is a farm king.

CHAPTER XXII

Miscellaneous

Miscellaneous Hints.

A furnace-heated cellar is a poor place to keep most vegetables and fruits. By packing in sand, which may be sprinkled with water occasionally, the drying effects of the air may be partially overcome, and the produce keeps better.

Spring is such a busy season, and there are so many different things which must be done at once on the country-place, that it is wise to do as much work in the fall of the year as possible, in the way of building, fencing, grading and getting ready generally.

Taken in time, two parts of wood ashes (sifted), two parts salt, and one part sulphur, thoroughly mixed and put within reach of the colt or horse is very good for expelling worms. Do not mix the above ingredients in their feed where they will be compelled to eat them, however. Put the compound in a small box where the animal can lick at it at will.—Forest Henry.

A little sugar added to the water used for basting the roast, especially if it be veal, improves the flavor.

A few bucketfuls of unslacked lime put in the cellar will help absorb moisture after heavy rains have left dampness or water on the cellar floors.

If vessels containing butter are perfectly dry, and if the air is kept away from the butter while it is in the cellar, there is no danger of mould. Mould is a plant growth and will only grow in dampness and heat.

Children's clothes can be made fireproof by adding to the last rinse water two ounces of pulverized alum. A prominent English chemist says that all children's dresses should be thus treated.

The compost heap is a prime need for every garden. A good way is to dig a pit in some corner of the yard, where you can put manure, leaves, house refuse of some sorts, grass litter, wood dirt, or any of the nitrogenous waste of a house and yard. If this is turned over now and then and wet with a hose, or occasionally watered with the suds from wash day, it will hasten decay.

This is a novel way to get rid of bugs and cut-worms. Nearly all of these fly some time in their lives and mostly at night. After the weather gets warm and the millers begin to fly, for they are cut-worms in another stage of existence, set a tub on a barrel or box in the garden, place a lighted candle in the center and water enough to come up about three inches. Let the candle burn all night and you will be surprised at the amount of bugs of all kinds that will be caught.—J. Cottar, Sumter, Minn.

If you have to move any old wire take the wire from the posts and leave it lying on the ground. Then make a very large ring of the end of the wire, as large as a wagon tire, and fasten with a stout piece of twine or fine wire. Roll this ring along on the wire, tying it occasionally to hold it. Fasten well when all is rolled up. Unroll by fastening the end to something first.

Every year people ask about "weed killers." The fighting agent in a weed killer is arsenic. The Rural New Yorker tells how to prepare the solution. Dissolve a tablespoonful of caustic soda in a gallon of warm water and then add all the white arsenic that will readily dissolve. This, sprayed or poured on the weeds will kill them, but be careful! It is a deadly poison. Keep children and animals away!

Poison Ivy or Oak.—There are three generally effective remedies for poison ivy or mercury. One is to apply hot water to the poisoned surface. Another is peroxide of hydrogen. The third is to apply a solution of sugar of lead about 40 grains to a pound of water. Two other remedies that are more or less effective are baking soda and dry starch.

The Farm Walks.—In planning the farm home, follow out the thought that we are making a picture, and all the colors should harmonize. In framing our picture we wish to make the better parts most prominent and cover and hide the ugly features with vines and shrubbery.

The barns should be given the best of attention. When making a new barn the first work is to grade properly. The slope should grade away in all directions from the house, making drives from roadway to barn and house. Drives to the barn should be direct, with an ornamental hedge set along the barn drive, if desired. The drive to the house should diverge in easy and natural curves, never losing sight of the thought that we are striving first for utility and second for beauty.

For a gravel drive, the driveway should be excavated to the depth of six to twelve inches, according to soil conditions, filling first with coarse gravel and then finish the last three or four inches with screened gravel. It should be pounded down close and with the center about two inches high at the highest, so that no water will stand on it. It should be built on the same principle as the city drive, with a covering of cement, and lightly creased about wash-boards, so as to prevent horses from slipping on them in icy weather. Nothing adds more to the appearance of a barn than a well made and well kept drive. The edges should always be kept straight and graded so that water will run off readily.

In packing butter, wash the butter well and be sure to work out all the buttermilk. Salt to suit the taste and make into small round rolls. For each two gallons of water take a pint of granulated sugar, two teaspoonfuls of saltpeter and enough table salt to make the fluid hold up a fresh egg. Boil this as long as any scum arises and keep it skimmed off. When perfectly free from scum allow it to cool and

place in a stone jar. Drop the rolls of butter into this as soon as they are made. Butter made in August has kept till late in the following spring.

Greens.—Horseradish tops as greens can be had all summer by cutting off all the top about once a week. New tops will then grow quickly. Used as greens your guests will not leave any for the next meal if you season well with salt, pepper and butter. A nice piece of corned beef boiled with them is good, and this eaten with boiled potatoes and a corn-meal pudding, boiled with the meat and vegetables, makes a menu that old New York farmers greatly appreciate. The pudding is made with eggs, dried fruit, milk, etc., as usual with corn-meal puddings. But when it is ready for cooking, tie it very tightly in a linen bag, so tight that the juices of the vegetables cannot get in, and boil at the bottom of the vegetable and beef kettle. When thoroughly done, untie and take off the sack, slice and serve with any good pudding sauce.

The spring is the season for "greens." Spinach is, of course, the stand-by, for every one can raise it, and it is so easily prepared for the table. Some may not know that spinach is wonderfully improved by adding fresh mustard leaves.

Dandelions are not only good, but medicinal. The only trouble with them, unless grown in a garden bed, is the work required to wash and shake out bits of grass.

Milkweed tops are par excellence and very easy to gather and prepare.

If you have cowslips down in the meadow, you are lucky. Did you ever use young nettles? Those who do tell us they are good.—The Farmer.

Trees and Vines.—In planting shade trees around the farm house bear in mind that some of them will grow to a great size. Leave plenty of space around the home for the fullest entry of sunshine and light, as well as plenty of fresh air.

In planting vines about the foundation of your house remove the soil to a depth of two feet, making a pocket two feet along the foundation and fifteen to eighteen inches across. Fill this with rich garden soil, to which has been added one-fifth of its bulk of very well-rotted manure. Into this plant the vines. If this is not done the vines will make a very poor showing like the majority of vines growing against the foundation walls of dwellings.

In using manure in tree and shrub planting, it is best to dig the holes six inches or a foot deeper than is necessary to accommodate the roots and the fertile soil directly beneath the roots. The thoroughly rotted manure is then put into the holes and mixed with a little soil. This is then covered with enough earth to fill the holes to the proper depth for planting. Before the plants are set tread down the soil and manure as firmly as possible. The tree is then planted in rich soil, using no manure about the roots. After the roots have been covered, but before the holes are entirely filled, place a few shovelfuls of rotted manure over the soil in the holes and fill in with

earth, firming the soil well during the whole operation. Mound the soil up well above the surrounding grade and then apply a heavy mulch of medium long manure, allowing it to extend out well over the roots on all sides of the newly set plants.

Curing Pork Or Bacon.

In curing pork for bacon and ham, for 100 lbs. of meat, use 7½ lbs. of good salt, 24 granulated sugar, and 4 saltpeter. Pulverize the saltpeter and mix all together. Rub the mixture on the pieces uniformly, and pack loosely in a cask or large stone crock or crocks. Fill the vessel with water. Keep all the meat under water, and let it lay in brine from six to seven weeks. Cure the meat as soon as the animal heat is out of it.

This is a good recipe for curing bacon. You will have no trouble with flies getting to meat cured by this recipe. Just hang the hams up in the cellar after curing and do not cover them at all; they get a little mouldy outside, but it is washed off in a few moments and the meat is so sweet and nice it is a pleasure to cut into it. The meat should be hung up or laid out (not piled up) for 48 hours after killing. For 200 lbs. of meat take 14 lbs. of salt, 5 lbs. granulated sugar, 6 ounces saltpeter, 8 ounces powdered borax and 1 lb. black pepper. Mix all ingredients together. Brush each piece of meat all over, rind and all, with molasses. Put some in a saucer and with the hand rub it all over meat, then sprinkle on and rub well in some of the salt mixture, putting plenty around the bones. There is a bone top of the leg that must be removed down to the ball and socket joint, or the ham will taint, for there is always some blood there.—Farm, Stock & Home.

Pickle for Pork.—Here is a recipe that has been tried for several years for family use and is guaranteed for the climate of the central states: For 100 pounds of pork take 10 pounds of salt, 2¼ pounds of brown sugar, 2 ounces of pepper, 2 ounces of soda, 2 ounces of saltpeter, and water enough to make a brine that will float an egg. Pack meat in barrel . Boil and skim the brine of sediment. When cool, cover the meat with the brine, weight it down, and be sure it is all covered. Add the pepper after skimming. Let it remain in brine 4 or 5 weeks, or until it is salt enough, smoke and let hang in an open dry place. Rub well with powdered borax and no insect will ever bother it. Leave the meat in the pickle until wanted and it never spoils. A large stone crock is better than a barrel for packing.

Dried Beef.—The round is commonly used for dried beef, the inside of the thigh being considered the choicest piece, as it is slightly more tender than the outside of the round. The round should be cut lengthwise of the grain of the meat in preparing for dried beef, so that the muscle fibers may be cut crosswise when the dried beef is sliced for table use. A tight jar or cask is necessary for curing. The process is as follows: To each 100 pounds of meat weigh out 5 pounds of salt, 3 pounds of granulated sugar, and 2 ounces of saltpeter; mix thoroughly together. Rub the meat on all surfaces with a third of the mixture and pack it in the jar as tightly as possible.

Allow it to remain three days, when it should be removed and rubbed again with another third of the mixture. In repacking put at the bottom the pieces that were on top the first time. Let stand for three days, when they should be removed and rubbed with the remaining third of the mixture and allowed to stand for three days more. The meat is then ready to be removed from the pickle. The liquid forming in the jars should not be removed, but the meat should be repacked in the liquid each time. After being removed from the pickle the meat should be smoked and hung in a dry attic or near the kitchen fire, where the water will evaporate from it. It may be used at any time after smoking, although the longer it hangs in the dry atmosphere the drier it will get. The drier the climate, in general, the more easily meats can be dried. In arid regions good dried meat can be made by exposing it fresh to the air, with protection from flies.

Smokehouse.

These directions for building a smokehouse are taken from "The Farmer":

Take a salt or apple barrel (a larger barrel would be better), bore small holes in the bottom of the barrel for the string of each ham. I set mine in the garden, so there will be no hay or straw near in case of fire. Put a length of stove pipe in a trench so the pipe will be a little lower than the surface top of the ground, turn the barrel over one end of the pipe. At the other end of the pipe dig your fireplace, 12 or 15 inches square. Cover it with an old pan, piece of sheet iron or anything that will not burn or let the smoke and fire out. Now hang the meat in the barrel, straighten the barrel up, stake or weight it so dogs will not upset it, build your fire, put a weight on the cover so the wind will not blow it off (I live in a windy country), and your meat will smoke if you keep a little fire for a week or so. I take hams from the brine, put them in water till they are fresh enough to cook without freshing, take from the water, scrape and wipe dry and let lay for a day to dry. Put in the strings to hang them by, then rub this mixture dry around the bone and fleshy side of ham: One-third sugar and black papper, two-thirds salt. When they are smoked take down, wrap in paper, put them in these 50-lb. flour sacks just as they are after taking the flour out, pull a grain sack that has no holes in over the flour sack, hang in any dry place. We hang ours in the granary. Tie the openings in the sacks so flies and bugs cannot get into the sacks.

For Dyspeptics. One hour before each meal drink a cup of water as hot as can be taken (sipped) conveniently; drink nothing at meals except milk, and nothing within one hour after meals, and a longer period, say three hours, is better, or until digestion is well under way; then drink all the water you wish, but avoid tea and coffee at any time; also rich pastries and fried or greasy foods; study your own case and find out what agrees with you and avoid all that does not.

One item of importance is, get hungry before eating. The object of the hot water before meals is to wash the stomach, and allow time

for the juices to collect before they are needed again. The reason for not drinking with the meals is that the gastric juice is already too weak to digest the food, hence the fermentation, and any liquid only dilutes it and makes a bad matter worse. Milk being a solid as soon as it enters the stomach does not dilute, but strengthens and aids the organs in their work. If food is eaten slowly and thoroughly masticated, there will be no need of anything to "wash it down.". Live on very plain food, which is a great saving in labor, suffering and doctors' bills.

A Minnesota Orchard.

This orchard was cared for by the writer during the summer of 1910, and is situated at the beautiful summer home of Senator J. M. Hackney, of St. Paul. This home is at Lake Josephine, on Hamline Avenue, four miles north of Como Park.

The orchard has (200) two hundred or more trees, both apples and plums. I began the cultivation of these trees about the first of May. I used a fork-spade and worked the soil thoroughly to the depth of the tines of the spading fork, and the soil was worked from six to eight feet in diameter. I did this three times each month during the entire growing season, and put on a mulch from twelve to sixteen inches deep and from eight to ten feet in diameter. I continued cultivation until as late as September.

This kind of cultivation retains the moisture for the setting of the buds in the fall, and consequently we find the next season that nearly all these trees were heavy laden with a very large and fine quality of fruit, containing a very fine flavor, while fruit trees of the same varieties which were not cultivated in this same way failed to bear fruit the next season. The main cause of this failure was a lack of moisture at the time when the buds were to set for the next year's crop.

All fruit orchards must be thoroughly cultivated and well manured yearly. Use coarse barnyard manure, put on a heavy dressing in the fall of the year, after the fruit is harvested, and in the spring cultivate it thoroughly into the soil. Also an excellent fertilizer for both orchards and gardens is occasionally a dressing of lime worked thoroughly into the soil around the trees and plants.

Do not allow grains of any kind or garden vegetables or shrubbery of any kind to be sown or planted in a young orchard, as this takes the richness from the soil, as well as the moisture, which the fruit trees require in order to bear a good crop each year.

To destroy insects on fruit trees spray well just before they bloom and when the little apples or plums are about as large as a good sized pea or bean, spray thoroughly again, two or three times, as it may require, and you will not be troubled with insects.

The fruit orchard should always be protected from severe weather, and especially the blasting east wind. Often when an orchard was in full bloom a blasting east wind has destroyed the whole crop.

A good protection is a hedge or a grove, which should be planted

a distance of 75 to 100 feet from the orchard, so as to let a good current of air pass between the hedge or grove and the orchard.

Buckthorn makes the best hedge, as it is hardy and will thrive in all kinds of weather and can stand a drouth better than any other kind of a hedge known. It must be from 10 to 12 feet high to protect the orchard with good results.

A few walnut and butternut trees are excellent shade trees for the grove. They are easily grown and are good shade trees, and bear fruit in abundance in a Minnesota climate.

1. **The Planting.**—The trees were set out about the middle of April, 1911. It contains 65 trees, mostly apple trees, some plum trees and some cherry trees. They all lived and made a sturdy growth during the summer months, and this photograph was taken of the orchard October 20, 1911.

2. **Mulching and Care.**—It was mulched well soon after planting, covering the entire surface of the orchard with straw about fourteen inches in depth, the deeper the mulch the less the evaporation. It has been clearly demonstrated that a large part of the water which is spread over the surface in summer irrigation passes from the soil into the atmosphere without serving any useful purpose. It has been tested that the proper mulching of the entire surface will retain all the moisture in the soil. Do not remove the straw mulching from the surface, but cultivate it thoroughly into the soil, and when this is done put a second coat of straw or barnyard manure mulch over the entire surface.

A Western New York Thanksgiving Dinner at the Farm House.

Twenty-five years ago all the accessories that go to make up the Thanksgiving dinner at a farm were produced on the same farms and those dinners perhaps cannot be duplicated in even the best of our hotels today. Surely, at least, one does not enjoy them in the same way. The following is the menu:

Young Roast Pig and Dressing
Roast Turkey Fried Chicken
Homemade Dried Beef
Mashed Potatoes Mashed Turnips
Baked Squash
Pickled Cucumbers Peaches Grapes Pears
Light Cream Biscuits Maple Syrup
Honey
Mince Pie Pumpkin Pie
Preserved Peaches or Quinces
Fruit Cake Cookies
Coffee Tea
Nuts—Assorted

This menu not only shows a varied assortment but there was always such an abundance of every article served.

One man said that if he took just one taste of everything served he would consider it a good meal.

Delicious cream and butter were served and used in preparing the above feast. The wheat for the biscuits was taken to the grist mill and converted into flour. These biscuits, with honey and maple syrup, would make a meal in itself and led one farmer to admonish his son not to kill himself by eating them. The mashed potatoes were seasoned well with good butter, salt and pepper and the turnips were prepared in the same way. Meat was had in plenty to suit a variety of tastes; the roast turkey and roast pig (six weeks, and specially fed for this occasion) probably the ruling favorites, with chicken fried in butter coming close.

The mince meat for pies was all from home products. It consisted of meat, apples, dried fruit and boiled cider. With this was served either apple or pumpkin pies. Many preserves and pickles were brought from the cellars and served as relishes with the meats. The pickles were all prepared in the best of pure, sweet apple cider, made on the place.

Cookies in variety and fruit cake were indispensable and were taken with the tea or coffee.

If, when this was finished, anybody still felt hungry, nuts grown on the farm were eaten. Sometimes these were reserved until later. Butternuts, hickory, chestnuts, black walnuts and beech nuts formed the assortment.

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